UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

MAR 27 2002

In Reply Refer To:
SWR-01-SA-6020:MET

Colonel Michael J. Walsh
District Engineer, Sacramento District
U.S. Army Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

Dear Colonel Walsh:

Please find enclosed the National Marine Fisheries Service's (NMFS) final biological opinion concerning the effects of operations of Englebright Dam and Daguerre Point Dam on the Yuba River, California, the threatened Central Valley spring-run chinook salmon (*Oncorhynchus tshawtscha*), the Central Valley steelhead (*O. mykiss*), and their respective designated critical habitats (Enclosure 1).

The biological opinion concludes that the proposed project is not likely to jeopardize the continued existence of the above listed species, nor will it result in the adverse modification of their respective critical habitats. Because NMFS believes there is the likelihood of incidental take of listed species as a result of the proposed water management operations, an incidental take statement is also attached to the biological opinion. This take statement includes reasonable and prudent measures that NMFS believes are necessary and appropriate to reduce, minimize, and monitor project impacts. Terms and conditions to implement the reasonable and prudent measures are presented in the take statement and must be adhered to in order for take incidental to this project to be exempted from the take prohibitions of the Endangered Species Act.

The total time period to be covered under this biological opinion shall not exceed five years from the date of its issuance. At that time all provisions of this biological opinion shall expire, including any coverage for incidental take. The U.S. Army Corps of Engineers (Corps) will then be required to reinitiate formal consultation on the effects of operations of Englebright Dam and Daguerre Point Dam on any species which may be listed at that time. The reason for the establishment of this time limit is that several important programs are currently underway which will provide extensive new information on the impacts and potential solutions to those impacts associated with the Corps' Yuba River operations. One of these programs is a large scale investigation known as the Upper Yuba River Studies Program. These studies are intended to determine if the reintroduction of wild chinook salmon and steelhead to the upper Yuba River above Englebright Dam is biologically, environmentally, and socio-economically feasible over the long term. In addition, this program is intended to determine the best method for providing access for anadromous fish to the upper river if this is found to be a feasible alternative.

There is also a large scale effort underway, led by the California Department of Water Resources (DWR) and the Corps to improve fish passage at Daguerre Point Dam. The purpose of this project is to examine the various options for minimizing the upstream and downstream passage problems posed by Daguerre Point Dam. The potential solutions being considered range from moderate improvements to the fish ladders to complete removal of the dam. The environmental review process has been initiated on this project and an action alternative is expected to be selected within the next two years.

There are several other somewhat smaller scale projects and programs either in the planing stages or underway on the lower Yuba River that involve various attempts to improve conditions for the anadromous fisheries. These include efforts to modify the hydroelectric facilities on Englebright Dam to improve water temperatures and reduce the risk of large scale flow fluctuations on the lower river, a plan to improve a structure designed to prevent adult salmonids from straying into the Yuba Goldfields, and several other small scale habitat improvement projects.

It is likely that within the next three to five years, these studies and projects will generate extensive new information and insights into potential solutions and remedies to the impacts associated with the Corps' dams on the Yuba River. For this reason, NMFS has deemed it prudent to limit the scope and time period for this biological opinion to five years and to require the reinitiation of consultation at that time in order to incorporate any new information into a long term, comprehensive solution to these problems.

In addition, we have attached an Essential Fish Habitat (EFH) consultation document, including EFH conservation recommendations (Enclosure 2). The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) set forth new mandates for NMFS and federal action agencies to protect important marine and anadromous fish habitat. Federal action agencies which fund, permit, or carry out activities that may adversely impact EFH are required to consult with NMFS regarding potential adverse effects of their actions on EFH, and respond in writing to NMFS "EFH Conservation Recommendations." The Pacific Fisheries Management Council has identified EFH for the Pacific salmon fishery in Amendment 14 to the Pacific Coast Salmon Fishery Management Plan. This EFH designation includes the habitat found in the lower Yuba River which is affected by the Corps' proposed operations of Englebright and Daguerre Point Dams.

We appreciate your continued cooperation in the conservation of listed species and their habitat, and look forward to working with you and your staff in the future. If you have any questions regarding this document, please contact Mr. Michael Tucker in our Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, CA 95814. Mr. Tucker may be reached by telephone at (916) 930-3604 or by Fax at (916) 930-3629.

Sincerely,

Rodney R McInnis

Rodney R. McInnis
Acting Regional Administrator

cc: NMFS-PRD, Long Beach, CA
Stephen A. Meyer, ASAC, NMFS, Sacramento, CA
Dean Swickaid, BLM, Folsom, CA

Enclosure 1

BIOLOGICAL OPINION

Agency: U.S. Army Corps of Engineers

Activity: Operations of Englebright Dam/Englebright Lake and Daguerre Point Dam on the Yuba River, California

Consultation Conducted By: Southwest Region, National Marine Fisheries Service.

Date Issued: MAR 27 2002

I. BACKGROUND AND CONSULTATION HISTORY

Following a National Marine Fisheries Service (NMFS) review of federal activities on the Yuba River in the spring of 1999, NMFS determined that activities associated with U.S. Army Corps of Engineers (Corps) projects may affect listed salmonids on the Yuba River. In a letter dated May 25, 1999, NMFS requested that the Corps initiate formal consultation under Section 7(a)(2) of the Endangered Species Act (Act) for ongoing impacts of the Corps' Daguerre Point Dam, Englebright Dam and the execution of rights of way and other agreements, contracts and licenses between the Corps and various water development concerns on listed salmonids and critical habitats in the Yuba River.

Prior to this, on March 8, 1999, the South Yuba River Citizens League (SYRCL) and Yuba Goldfields Access Coalition (YGAC) filed a Notice of Intent to Sue (NOI) under the citizens suit provisions of the ESA. In their NOI, SYRCL and YGAC sought to compel the Corps to initiate a section 7 consultation for its activities on the Yuba River.

By letter dated August 13, 1999, the Corps indicated that it did not intend to engage NMFS in consultation at that time for actions on the Yuba River. Based on its review of the Corps' actions, NMFS did not concur with the Corps conclusions and again requested that the Corps initiate consultation. Pursuant to negotiations between the Corps, the Department of Justice (DOJ) and NMFS along with separate discussions between the DOJ and counsel for SYRCL and YGAC, the Corps and NMFS staff agreed on a scope and schedule for the Corps to complete a biological assessment and initiate a section 7 consultation. This agreement, along with NMFS concurrence, served as a settlement, brokered by DOJ, for SYRCL and YGAC to withdraw their suit against the Corps.

By letter dated March 6, 2000, the Corps formalized this agreement to prepare a biological assessment (BA) and initiate a section 7 consultation for Corps activities at Daguerre Point Dam and Englebright Dam. Following several meetings, telephone conferences and correspondences during which a BA was developed and amended several times, the Corps submitted its final BA on February 21, 2001 with a request for initiation of formal Section 7 consultation. After extensive consultation and collection of information, NMFS requested a 90-day extension to the consultation period in a letter dated July 24, 2001. This request was granted by the Corps via a letter dated August 27, 2001.

There are several processes underway involving fisheries restoration and the reduction of impacts associated with the two dams on the lower Yuba River. A large scale investigation is underway, known as the Upper Yuba River Studies Program. This comprehensive program funded by the CalFed Bay Delta Program, is intended to determine if the reintroduction of wild chinook salmon and steelhead to the upper Yuba River above Englebright Dam is biologically, environmentally and socio-economically feasible over the long term. This program is in the implementation phase of conducting multiple detailed studies to examine the various issues involved with the reintroduction process including habitat suitability, water supply and hydropower impacts, flood risk, water quality, and economic issues. The goal is to determine the feasibility of reintroduction and the best method to accomplish this goal.

There is also a large scale effort underway, led by the California Department of Water Resources (DWR) and the Corps to improve fish passage at Daguerre Point Dam. The purpose of this project is to examine the various options for minimizing the upstream and downstream passage problems posed by Daguerre Point Dam. The potential solutions being considered range from moderate improvements to the fish ladders to complete removal of the dam. The NEPA/CEQA process has been initiated on this project and a final decision is expected to be made within the next two years.

There are several other smaller scale projects and programs either in the planning stages or underway on the lower Yuba River that involve various efforts to improve conditions for anadromous fisheries, including efforts to modify the hydroelectric facilities on Englebright Dam to improve water temperatures and reduce the risk of large scale flow fluctuations on the lower river and a plan to improve a structure designed to prevent adult salmonids from straying into the Yuba Goldfields.

It is likely that within the next three to five years, these studies and projects will generate extensive new information and insights into potential solutions and remedies to the impacts associated with the Corps' dams on the Yuba River. For this reason, NMFS is limiting the scope and time period for this biological opinion to five years, and requiring the Corps to reinitiate consultation at that time in order to incorporate any new information.

II. DESCRIPTION OF THE PROPOSED ACTION

Delineation and Description of the Action Area

The action area is defined in 50 CFR 402.02 as all areas to be affected directly or indirectly by the federal action, and not merely the immediate area involved in the action. The action area for this project includes the active stream channels and riparian corridors of the Yuba River starting at and including Englebright Dam and Reservoir (39°14'18"N, 121°16'07"W, Yuba River mile 23.9), downstream to the confluence with the Feather River (39°07'46"N, 121°35'56"W, Yuba River mile 0), including Daguerre Point Dam and all water diversion facilities associated with the two dams. This area shall be referred to as the lower Yuba River.

Description of the Proposed Action

The proposed action considered in this opinion is the continuation of current Corps operations of Englebright and Daguerre Point Dams on the Yuba River in Yuba and Nevada counties, CA. An important component of the Corps operations is the issuance of permits, licenses and easements to non-federal entities for their operations of water diversion facilities at or near the dams.

Englebright Dam/Englebright Lake

Englebright Dam is 260 feet high, stores 70,000 acre-feet of water as designed, and was constructed in 1941 to retain hydraulic mining debris. The Corps administers the operation and maintenance of Englebright Dam, which plays only a small role in the flood control operations on the Yuba River. The primary flood control reservoir on the Yuba River is New Bullards Bar Reservoir located above Englebright Reservoir on the North Yuba River which is operated by the Yuba County Water Agency (YCWA). Although hydraulic mining is no longer active in the upper reaches of the Yuba River, Englebright Dam and Englebright Lake continue to capture any hydraulic mining debris remaining in the upstream areas. Englebright Dam has no fish ladders making it a complete barrier to upstream fish passage. The majority of releases from the reservoir are made through two hydroelectric power facilities, one of which (Narrows II) is located just below the base of the dam and the other (Narrows I), is located approximately 0.2 miles downstream. Water releases from the reservoir are administered by YCWA and Pacific Gas and Electric Company (PG&E) for hydroelectric power generation, irrigation and maintenance of the downstream riverine ecosystem. The Corps has issued Easement No. DACW05-9-95-604 to PG&E for Narrows I and Easement No. DACW05-2-75-716 to YCWA for Narrows II, granting permission for the powerhouses to be constructed, operated, and maintained at the dam. Furthermore, on March 28, 1994, the Corps entered into an agreement with PG&E for operation and maintenance of the Narrows I Hydroelectric Project. The 1994 agreement states that the Corps is responsible for maintaining Englebright Dam and the outlet facilities in good order and repair, while PG&E is responsible for the operation and maintenance of the hydroelectric facility.

Following the construction of New Bullards Bar Dam in 1969, the burden of flood control for the Yuba Basin was shifted from Englebright Lake to New Bullards Bar Reservoir, and Englebright Lake has since been kept nearly full most of the time (Federal Energy Regulatory Commission, 1992). As water is released from New Bullards Bar Dam for uses such as hydroelectric power, irrigation, and fisheries, the typical drawdown from July to December in Englebright Lake is about 9 feet. Water is released either through the Narrows I powerhouse (capacity of 730 cubic feet per second {cfs}) or through the Narrows II powerhouse (capacity of 3,425 cfs). If Englebright Lake is full, surface water from the lake spills over the dam in excess of what can be handled through the hydroelectric power facilities. The flows into Englebright Lake are managed upstream at New Bullards Bar Reservoir and other upstream reservoirs, which are filled by natural runoff from the upper Yuba, North, Middle, and South Yuba River subbasins.

Daguerre Point Dam

The Rivers and Harbors Act of 1902 authorized the construction of the Yuba River Debris Control Project, of which Daguerre Point Dam is a part. Construction of Daguerre Point Dam was funded through a 50-50 cost share between the U.S. California Debris Commission and the State of California. The dam was completed in May of 1906 but the river was not diverted over the dam until 1910. The flood of February 1963 washed out a large section from the center of the dam and before significant repairs could be made, the flood of December 1964 washed out much of the rest of the dam and eroded the underlying rock foundation to an estimated depth of 15 to 25 feet. The floods of 1964 also washed out nearly all of the sediments and debris that had accumulated behind the dam up to that point. Following the winter of 1964 the dam was entirely reconstructed except for a short section of the right abutment. Reconstruction of the dam, including the extension and rehabilitation of both fish ladders, was completed in October 1965 (Corps 2001). The current configuration of Daguerre Point Dam is an overflow concrete ogee ("s-shaped") spillway with concrete apron and concrete abutments. The ogee spillway section is 575 feet wide and 25 feet tall. The purpose of Daguerre Point Dam was to retain hydraulic mining debris. This purpose was later modified to include diversion of water for irrigation purposes. The dam is not operated for flood control and there is no water storage capacity as the entire reservoir has been filled with hydraulic mining debris and sediments. When the California Debris Commission was decommissioned, they turned administration of the dam over to the Corps and the State Department of Water Resources. The park personnel of the Corps administer the operation of the fish ladders and maintenance of Daguerre Point Dam.

There are two irrigation diversions licensed by the Corps and one diversion that is not on Corps property and therefore does not require a licence. All three diversions depend on the elevated head created by the dam to gravity-feed their canals. The Corps has issued easements and licenses for the two diversions located on Corps property at Daguerre Point Dam. On November 3, 1911, a perpetual license was issued to the Hallwood Irrigation Company for the Hallwood/Cordua diversion located on the north side of the river. The Corps has assigned License No. DAW05-3-97-549 to this perpetual license. License number DACW05-3-85-537 was issued to South Yuba Water District on March 15, 1985 for the South Yuba/Brophy diversion located on the south side of the river. This license is currently in a hold-over status, as it expired in March 2000.

Hallwood-Cordua diversion

The Hallwood-Cordua diversion is located on the north side of Daguerre Point Dam with the intake facilities directly connected to the superstructure of the dam. There is an interim fish screen on the Hallwood-Cordua Canal approximately one quarter mile down the canal from the river which was rebuilt in the spring of 2000. Although this screen still does not meet all DFG and NMFS criteria, the rehabilitation efforts included the installation of the proper sized screening material and have allowed continuous operation of the screen throughout the irrigation season along with the direct return of screened fish back to the river below the dam. The Hallwood-Cordua diversion provides irrigation water to the District 10 - Hallwood area.

The Hallwood Irrigation District is entitled to 78,000 acre-feet, and the Cordua District is entitled to 82,000 acre-feet of Yuba River water.

South Yuba-Brophy diversion

About 1,000 feet upstream of Daguerre Point Dam on the south side of the river, the South Yuba-Brophy diversion diverts water through an excavated channel from the Yuba River's south bank. The South Yuba-Brophy diversion is fitted with a loose cobble weir which was intended to protect juvenile fish from becoming entrained into the canal but does not meet DFG or NMFS screening criteria. The inadequacies of this device are discussed in detail in the *Effects of the Action* section of this document. The Brophy Water District uses the South Yuba-Brophy diversion for drawing 35,330 acre-feet of water from the Yuba River. It is gravity fed with some lift stations. The area irrigated by this water is in the southern portion of the county from the Yuba Goldfields southward to Erle Road and west to about Griffith Avenue.

Brown's Valley diversion

Approximately 4,200 feet upstream of Daguerre Point Dam, the Brown's Valley Canal diverts water from the north bank of the river at estimated flows of up to 100 cfs. The water enters an excavated side channel and is then pumped up into the canal. Currently, these pumps are screened with a device that meets DFG and NMFS screening criteria. Although this diversion depends on the elevated head provided by Daguerre Point Dam to draw its water, it is not licensed by the Corps as it has no direct physical link to Corps property. The Brown's Valley Diversion serves a 50,000-acre area for irrigation from Englebright Dam to the Brown's Valley and Lama Rica areas north to the Butte County line. The Brown's Valley Irrigation District is entitled to 25,687 acre-feet. The water is drawn primarily from Merle Collins Reservoir and some from the Yuba River.

YCWA has contractual agreements to deliver water from New Bullards Bar Reservoir to these irrigation districts (QUAD Consultants, 1994). The three diversions have a combined capacity of 1,085 cfs.

After construction of Daguerre Point Dam, crude fish ladders were installed in 1911, but they were washed out in the floods of 1927-1928. These ladders were not replaced until the construction of new fish ladders in 1938, leaving a 10 year period of no fish passage at Daguerre Point Dam from 1928 to 1938. Fish ladders were repeatedly reconstructed after flood washouts in 1942, 1949, 1952, and 1965. The ladders constructed in 1938 consisted of 8- by 10-foot bays arranged in steps with about 1 foot of difference in elevation between steps. Extensions to the fish ladders were added in 1964, and slide gates were added to both upstream ends of the ladders in 1965 (Corps 2001).

Under project authority, the Corps implements conservation measures while working with the California Department of Fish and Game (DFG) to maintain the two fish ladders by clearing debris when needed. In 2000, the Corps also implemented dredging of the sediment in the area immediately above the exit of the north fish ladder as a conservation measure to provide improved fish passage. In coordination with the U.S. Fish and Wildlife Service (FWS), DFG, and NMFS, the Corps is currently conducting a fish passage improvement study of Daguerre Point Dam. Alternatives being examined include a wide range of actions ranging from removal of the dam to constructing new state-of-the-art fish ladders.

Lower Yuba Tributaries

Deer Creek and Dry Creek are 1.2 miles and 10.3 miles downstream of Englebright Dam respectively. There is a significant falls approximately 500 feet upstream of the mouth of Deer Creek which is likely impassable during drier years, but steelhead have been found above the falls during wetter years when there is high runoff (DFG, 1991). The flows on Dry Creek are regulated at Merle Collins Reservoir. There is a considerable amount of accessible spawning and rearing habitat in Dry Creek in years with favorable hydrologic conditions and a 1983 survey found that Dry Creek had a self-sustaining population of fall-run salmon estimated to be 500 fish (Preston, 1986).

Conservation and restoration measures

The Corps has also committed to incorporate several conservation and restoration measures as part of their project operations which are intended to reduce take of listed salmonids by alleviating some of the adverse impacts associated with the ongoing projects. The following statements have been taken verbatim from the Corps' project description:

1. The Corps will coordinate with the Department of Water Resources, Bureau of Reclamation, YCWA, Federal Energy Regulatory Commission, PG&E, NMFS, DFG, and FWS in managing flows from New Bullards Bar Reservoir and Englebright Lake to further enhance critical habitat (instream and SRA) and water temperature in the Yuba River downstream of Englebright Lake.

2. The Corps will coordinate with NMFS, DFG, and the FWS on developing and implementing an economical gravel injection program in key areas (i.e., pool/riffle interface) since there is a lack of spawning gravels, especially for steelhead, below Englebright Dam.

3. Once funds are provided by CALFED to allow YCWA implementation of a recently approved plan that reduces the effects resulting from fluctuations in flows during the maintenance of brushes at Narrows #1 and Narrows #2, the Corps will participate in the coordination of any subsequent meetings with PG&E, YCWA, NMFS, DFG, and the FWS; and review plans and specifications once they are submitted by YCWA.

4. Pending approval and funding from CALFED, the Corps will provide any further coordination and assistance for YCWA to construct a temperature control device and construct a full-flow bypass at their Narrows #2 powerhouse, which is currently being pursued by YCWA through a CALFED grant application.

5. The Corps will develop and implement a plan that routinely clears debris from the two fish ladders and construct sides and/or trash racks on the ladder exits to divert some of the debris away from the ladder. The plan will be added to the requirements contained in the Corps Operation and Maintenance Manual for Daguerre Point Dam.

6. The Corps will install an inexpensive remote pressure/transducer device in the ladders to monitor the debris accumulating in each ladder.

7. The Corps will develop and implement a plan to routinely remove the sediment that occasionally accumulates in front of the north ladder exit that could block upstream passage. The plan will be added to the requirements contained in the Corps Operation and Maintenance Manual for Daguerre Point Dam.

8. The Corps will coordinate with the Brophy Irrigation District, NMFS, DFG, and the FWS to investigate, design, and implement an economical plan to improve conditions for juvenile salmonids at the South Yuba - Brophy irrigation diversion (i.e., reduce predation in a small area near the entrance of the diversion where a pool creates more suitable habitat that attracts warm water fish, clear debris and maintain unimpeded flow-through of return channel, and improve screening function).

III. STATUS OF LISTED SPECIES AND DESIGNATED CRITICAL HABITAT

The following listed species and designated critical habitats are likely to be affected by the proposed project:

- Central Valley spring-run chinook salmon - threatened
- Central Valley spring-run chinook salmon Critical Habitat
- Central Valley steelhead - threatened
- Central Valley steelhead Critical Habitat

Central Valley Spring-run Chinook Salmon - Threatened

<u>Status and trends</u>
Effective November 16, 1999, NMFS listed Central Valley spring-run chinook salmon as threatened under the Endangered Species Act (64 FR 50394). Historically, spring-run chinook salmon were predominant throughout the Central Valley, occupying the upper and middle reaches of the San Joaquin, American, Yuba, Feather, Sacramento, McCloud, and Pit Rivers, with smaller populations in most other tributaries with sufficient habitat for over-summering adults (Stone 1874, Rutter 1904, Clark 1929). The Central Valley drainage as a whole is estimated to have supported spring-run chinook salmon runs as large as 600,000 fish between the late 1880s and 1940s (DFG 1998). Before the construction of Friant Dam, nearly 50,000 adults were counted in the San Joaquin River (Fry 1961). Following the completion of Friant Dam, the native population from the San Joaquin River and its tributaries was extirpated. Also, spring-run no longer exist in the American River due to Folsom Dam.

Clark (1929) estimated that originally there were 6,000 miles of salmon habitat in the Central Valley system and that 80% of this habitat had been lost by 1928. Yoshiyama et al. (1996) calculated that roughly 2,000 miles of salmon habitat was actually available before dam construction and mining, and concluded that 82% is not accessible today. Clark (1929) did not give details about his calculation. Whether Clark's or Yoshiyama's calculation is used, only remnants of the former range remain accessible today in the Central Valley (DFG 1998).

Impassable dams block access to most of the historical headwater spawning and rearing habitat of Central Valley spring-run chinook salmon. In addition, much of the remaining, accessible spawning and rearing habitat is severely degraded by elevated water temperatures, agricultural and municipal water diversions, unscreened and poorly screen water intakes, restricted and regulated streamflows, levee and bank stabilization, and poor quality and quantity of riparian and shaded riverine aquatic (SRA) cover.

Natural spawning populations of Central Valley spring-run chinook salmon are currently restricted to accessible reaches in the upper Sacramento River, Antelope Creek, Battle Creek, Beegum Creek, Big Chico Creek, Butte Creek, Clear Creek, Deer Creek, Feather River, Mill Creek, and Yuba River (DFG 1998; FWS, unpublished data). With the exception of Butte Creek and the Feather River, these populations are relatively small ranging from a few fish to several hundred. Butte Creek returns in 1998 and 1999 numbered approximately 20,000 and 3,600, respectively (DFG unpublished data). On the Feather River, significant numbers of spring-run chinook, as identified by run timing, return to the Feather River Hatchery. However, coded-wire-tag information from these hatchery returns indicates substantial introgression has occurred between fall-run and spring-run chinook populations in the Feather River due to hatchery practices.

Life history and habitat requirements

Spring-run chinook salmon adults are estimated to leave the ocean and enter the Sacramento River from March to July (Myers et al. 1998). This run timing is well adapted for gaining access to the upper reaches of river systems, 1,500 to 5,200 feet in elevation, prior to the onset of high temperatures and low flows that would inhibit access to these areas during the late summer and fall. Throughout this upstream migration phase, adults require streamflows sufficient to provide olfactory and other orientation cues used to locate their natal streams. Adequate streamflows are also necessary to allow adult passage to upstream holding habitat in natal tributary streams. The preferred temperature range for spring-run chinook salmon completing their upstream migration is 38° F to 60° F (DFG 1998).

When they enter freshwater, spring-run chinook salmon are immature and they must stage for several months before spawning. Their gonads mature during their summer holding period in freshwater. Over-summering adults require cold-water refuges such as deep pools to conserve energy for gamete production, redd construction, spawning, and redd guarding. The upper limit of the optimal temperature range for adults holding while eggs are maturing is 59° F to 60° F. Unusual stream temperatures during spawning migration and adult holding periods can alter or delay migration timing, accelerate or retard mutations, and increase fish susceptibility to diseases. Sustained water temperatures above 80.6° F are lethal to adults (Cramer and Hammack 1952; DFG 1998).

Adults prefer to hold in deep pools with moderate water velocities and bedrock substrate and avoid cobble, gravel, sand, and especially silt substrate in pools (Sato and Moyle 1989). Optimal water velocities for adult chinook salmon holding pools range between 0.5-1.3 feet-per-second and depths are at least three to ten feet (G. Sato unpublished data, Marcotte 1984). The pools typically have a large bubble curtain at the head, underwater rocky ledges, and shade cover throughout the day (Ekman 1987).

Spawning typically occurs between late-August and early October with a peak in September. Once spawning is completed, adult spring-run chinook salmon die. Spawning typically occurs in gravel beds that are located at the tails of holding pools (USFWS 1995). Spring-run adults have been observed spawning in water depths of 0.8 feet or more, and water velocities from 1.2-3.5 feet-per-second (Puckett and Hinton 1974). Eggs are deposited within the gravel where incubation, hatching, and subsequent emergence takes place. Optimum substrate for embryos is a mixture of gravel and cobble with a mean diameter of one to four inches with less than 5% fines, which are less than or equal to 0.3 inches in diameter (Reiser and Bjornn 1979). The upper preferred water temperature for spawning adult chinook salmon is 55° F (Chambers 1956) to 57° F (Reiser and Bjornn 1979).

Length of time required for eggs to develop and hatch is dependant on water temperature and is quite variable, however, hatching generally occurs within 40 to 60 days of fertilization (Vogel and Marine 1991). In Deer and Mill creeks, embryos hatch following a 3-5 month incubation period (USFWS 1995). The optimum temperature range for chinook salmon egg incubation is 44° F to 54° F (Rich 1997). Incubating eggs show reduced egg viability and increased mortality at temperatures greater than 58° F and show 100% mortality for temperatures greater than 63° F (Velson 1987). Velson (1987) and Beacham and Murray (1990) found that developing chinook salmon embryos exposed to water temperatures of 35° F or less before the eyed stage experienced 100% mortality (DFG 1998).

After hatching, pre-emergent fry remain in the gravel living on yolk-sac reserves for another two to four weeks until emergence. Timing of emergence within different drainages is strongly influenced by water temperature. Emergence of spring-run chinook typically occurs from November through January in Butte and Big Chico Creeks and from January through March in Mill and Deer Creeks (DFG 1998).

Post-emergent fry seek out shallow, nearshore areas with slow current and good cover, and begin feeding on small terrestrial and aquatic insects and aquatic crustaceans. As they grow to 50 to 75 mm in length, the juvenile salmon move out into deeper, swifter water, but continue to use available cover to minimize the risk of predation and reduce energy expenditure. The optimum temperature range for rearing chinook salmon fry is 50° F to 55° F (Boles et al. 1988, Rich 1997, Seymour 1956) and for fingerlings is 55° F to 60° F (Rich 1997).

In Deer and Mill creeks, juvenile spring-run chinook, during most years, spend 9-10 months in the streams, although some may spend as long as 18 months in freshwater. Most of these "yearling" spring-run chinook move downstream in the first high flows of the winter from November through January (USFWS 1995, DFG 1998). In Butte and Big Chico creeks, spring-run chinook juveniles typically exit their natal tributaries soon after emergence during December and January, while some remain throughout the summer and exit the following fall as yearlings. In the Sacramento River and other tributaries, juveniles may begin migrating downstream almost immediately following emergence from the gravel with emigration occurring from December through March (Moyle, et al. 1989, Vogel and Marine 1991). Fry and parr may spend time rearing within riverine and/or estuarine habitats including natal tributaries, the Sacramento River, non-natal tributaries to the Sacramento River, and the Delta. In general, emigrating juveniles that are younger (smaller) reside longer in estuaries such as the Delta (Kjelson et al. 1982, Levy and Northcote 1982, Healey 1991). The brackish water areas in estuaries moderate the physiological stress that occurs during parr-smolt transitions. Although fry and fingerlings can enter the Delta as early as January and as late as June, their length of residency within the Delta is unknown but probably lessens as the season progresses into the late spring months (DFG 1998).

In preparation for their entry into a saline environment, juvenile salmon undergo physiological transformations known as smoltification that adapt them for their transition to salt water. These transformations include different swimming behavior and proficiency, lower swimming stamina, and increased buoyancy that also make the fish more likely to be passively transported by currents (Saunders 1965, Folmar and Dickhoff 1980, Smith 1982). In general, smoltification is timed to be completed as fish are near the fresh water to salt water transition. Too long a migration delay after the process begins is believed to cause the fish to miss the "biological window" of optimal physiological condition for the transition (Walters et al. 1978). The optimal thermal range for chinook during smoltification and seaward migration is 50° F to 55° F (Rich 1997).

Chinook salmon spend between one and four years in the ocean before returning to their natal streams to spawn (Myers et al. 1998). Fisher (1994) reported that 87% of returning spring-run adults are three-years-old based on observations of adult chinook trapped and examined at Red Bluff Diversion Dam between 1985 and 1991.

Central Valley Spring-run Chinook Designated Critical Habitat

On February16, 2000, NMFS designated critical habitat for the Central Valley spring-run chinook salmon evolutionarily significant unit (ESU; 63 FR 11482). Critical habitat consists of the water, substrate, and adjacent riparian zone of accessible estuarine and riverine reaches. Accessible reaches are those within the historical range of the Central Valley spring-run chinook ESU that can still be occupied by any life stage of chinook salmon. Inaccessible reaches are those above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years) and specific dams within the historical range of each ESU. Adjacent riparian zones are defined as the area adjacent to a stream that provides the following functions: shade, sediment transport, nutrient or chemical regulation, streambank stability, and input of large woody debris or organic matter.

Critical habitat for Central Valley spring-run chinook is designated to include all river reaches accessible to chinook salmon in the Sacramento River and its tributaries in California. Also included are river reaches and estuarine areas of the Sacramento-San Joaquin Delta, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San

Pablo Bay to the Golden Gate Bridge. Excluded are areas above specific dams or above longstanding naturally impassable barriers.

Central Valley Steelhead - Threatened

Status and trends.

Effective May 18, 1999, NMFS listed Central Valley steelhead as threatened under the Endangered Species Act (63 FR 13347). Central Valley steelhead once ranged throughout most of the tributaries and headwaters of the Sacramento and San Joaquin basins prior to dam construction, water development, and watershed perturbations of the 19th and 20th centuries (McEwan and Jackson 1996). Historical documentation exists that show steelhead were once widespread throughout the San Joaquin River system (CALFED 1999). In the early 1960s, the California Fish and Wildlife Plan estimated a total run size of about 40,000 adults for the entire Central Valley including San Francisco Bay. The annual run size for this ESU in 1991-92 was probably less than 10,000 fish based on dam counts, hatchery returns and past spawning surveys (McEwan and Jackson 1996).

Estimates of steelhead historical habitat can be based on estimates of salmon historical habitat. The extent of habitat loss for steelhead is probably greater than losses for salmon, because steelhead go higher into the drainages than do chinook salmon (Yoshiyama et al. 1996). Clark (1929) estimated that originally there were 6,000 miles of salmon habitat in the Central Valley system and that 80% of this habitat had been lost by 1928. Yoshiyama et al. (1996) calculated that roughly 2,000 miles of salmon habitat was actually available before dam construction and mining, and concluded that 82% of what was present is not accessible today. Clark (1929) did not give details about his calculation. Whether Clark's or Yoshiyama's calculation is used, only remnants of the former steelhead range remain accessible today in the Central Valley.

As with Central Valley spring-run chinook, impassable dams block access to most of the historical headwater spawning and rearing habitat of Central Valley steelhead. In addition, much of the remaining, accessible spawning and rearing habitat is severely degraded by elevated water temperatures, agricultural and municipal water diversions, unscreened and poorly screen water intakes, restricted and regulated streamflows, levee and bank stabilization, and poor quality and quantity of riparian and shaded riverine aquatic (SRA) habitat.

At present, wild steelhead stocks appear to be mostly confined to upper Sacramento River tributaries such as Antelope, Deer, and Mill creeks and the Yuba River (McEwan and Jackson 1996). Naturally spawning populations are also known to occur in Butte Creek, and the upper Sacramento, Feather, American, Mokelumne, and Stanislaus rivers (CALFED 1999). However, the presence of naturally spawning populations appears to correlate well with the presence of fisheries monitoring programs, and recent implementation of new monitoring efforts has found steelhead in streams previously thought not to contain a population, such as Auburn Ravine, Dry Creek, and the Stanislaus River. It is possible that other naturally spawning populations exist in Central Valley streams, but are undetected due to lack of monitoring or research programs (IEP Steelhead Project Work Team 1999).

Life history and habitat requirements.
All Central Valley steelhead are currently considered winter-run steelhead (McEwan and Jackson 1996), although there are indications that summer steelhead were present in the Sacramento River system prior to the commencement of large-scale dam construction in the 1940's (IEP Steelhead Project Work Team 1999). Adult steelhead migrate upstream in the Sacramento River mainstem from July through March, with peaks in September and February (Bailey 1954, Hallock et al. 1961). The timing of upstream migration is generally correlated with higher flow events, such as freshets or sand bar breaches, and associated lower water temperatures. The preferred temperatures for upstream migration are between 46° F and 52° F (Reiser and Bjornn 1979, Bovee 1978, Bell 1986). Unusual stream temperatures during upstream migration periods can alter or delay migration timing, accelerate or retard mutations, and increase fish susceptibility to diseases. The minimum water depth necessary for successful upstream passage is 18 cm (Thompson 1972). Velocities of 3-4 meters per second approach the upper swimming ability of steelhead and may retard upstream migration (Reiser and Bjornn 1979).

Spawning may begin as early as late December and can extend into April with peaks from January through March (Hallock et al. 1961). Unlike chinook salmon, not all steelhead die after spawning. Some may return to the ocean and repeat the spawning cycle for two or three years; however, the percentage of repeat spawners is generally low (Busby et al. 1996). Steelhead spawn in cool, clear streams featuring suitable gravel size, depth, and current velocity. Intermittent streams may be used for spawning (Barnhart 1986, Everest 1973). Gravels of 1.3 cm to 11.7 cm in diameter (Reiser and Bjornn 1979) and flows of approximately 40-90 cm/second (Smith 1973) are generally preferred by steelhead. Reiser and Bjornn (1979) reported that steelhead prefer a water depth of 24 cm or more for spawning. The survival of embryos is reduced when fines of less than 6.4 mm comprise 20 - 25% of the substrate. Studies have shown a survival of embryos improves when intragravel velocities exceed 20 cm/hour (Phillips and Campbell 1961, Coble 1961). The preferred temperatures for spawning are between 39° F and 52° F (McEwan and Jackson 1996).

Length of time required for eggs to develop and hatch is dependant on water temperature and is quite variable; hatching varies from about 19 days at an average temperature of 60° F to about 80 days at an average of 42° F. The optimum temperature range for steelhead egg incubation is 46° F to 52° F (Reiser and Bjornn 1979, Bovee 1978, Bell 1986, Leidy and Li 1987). Egg mortality may begin at temperatures above 56° F (McEwan and Jackson 1996).

After hatching, pre-emergent fry remain in the gravel living on yolk-sac reserves for another four to six weeks, but factors such as redd depth, gravel size, siltation, and temperature can speed or retard this time (Shapovalov and Taft 1954). Upon emergence, steelhead fry typically inhabit shallow water along perennial stream banks. Older fry establish territories which they defend. Streamside vegetation is essential for foraging, cover, and general habitat diversity. Steelhead juveniles are usually associated with the bottom of the stream. In winter, they become inactive and hide in available cover, including gravel or woody debris.

The majority of steelhead in their first year of life occupy riffles, although some larger fish inhabit pools or deeper runs. Juvenile steelhead feed on a wide variety of aquatic and terrestrial insects, and emerging fry are sometimes preyed upon by older juveniles. Water temperatures influence the growth rate, population density, swimming ability, ability to capture and metabolize food, and ability to withstand disease of these rearing juveniles. Rearing steelhead juveniles prefer water temperatures of 45° F to 60° F (Reiser and Bjornn 1979, Bovee 1978, Bell 1986). Temperatures above 60° F have been determined to induce varying degrees of chronic stress and associated physiological responses in juvenile steelhead (Leidy and Li 1987).

After spending one to three years in freshwater, juvenile steelhead migrate downstream to the ocean. Most Central Valley steelhead migrate to the ocean after spending two years in freshwater (Hallock et al. 1961, Hallock 1989). Barnhart (1986) reported that steelhead smolts in California range in size from 14 to 21 cm (fork length). In preparation for their entry into a saline environment, juvenile steelhead undergo physiological transformations known as smoltification that adapt them for their transition to salt water. These transformations include different swimming behavior and proficiency, lower swimming stamina, and increased buoyancy that also make the fish more likely to be passively transported by currents (Saunders 1965, Folmar and Dickhoff 1980, Smith 1982). In general, smoltification is timed to be completed as fish are near the fresh water to salt water transition. Too long a migration delay after the process begins is believed to cause the fish to miss the "biological window" of optimal physiological condition for the transition (Walters et al. 1978). The optimal thermal range during smoltification and seaward migration for steelhead is 44° F to 52° F (Leidy and Li 1987, Rich 1997) and temperatures above 55.4° F have been observed to inhibit formation and decrease activity of gill (Na and K) ATPase activity in steelhead, with concomitant reductions in migratory behavior and seawater survival (Zaugg and Wagner 1973, Adams et. al 1973). Hallock et al. (1961) found that juvenile steelhead in the Sacramento Basin migrated downstream during most months of the year, but the peak period of emigration occurred in the spring, with a much smaller peak in the fall.

Steelhead spend between one and four years in the ocean (usually one to two years in the Central Valley) before returning to their natal streams to spawn (Barnhart 1986, Busby et al. 1996).

Central Valley Steelhead Designated Critical Habitat

On February16, 2000, NMFS designated critical habitat for the Central Valley steelhead ESU (63 FR 11482). Critical habitat consists of the water, substrate, and adjacent riparian zone of accessible estuarine and riverine reaches. Accessible reaches are those within the historical range of the Central Valley steelhead ESU that can still be occupied by any life stage of steelhead. Inaccessible reaches are those above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years) and specific dams within the historical range of each ESU. Adjacent riparian zones are defined as the area adjacent to a stream that provides the following functions: shade, sediment transport, nutrient or chemical regulation, streambank stability, and input of large woody debris or organic matter. Critical habitat for Central Valley steelhead is designated to include all river reaches accessible to listed steelhead in the Sacramento and San Joaquin Rivers and their tributaries in California. Also included are river reaches and estuarine areas of the Sacramento-San Joaquin Delta, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Excluded are areas of the San Joaquin River upstream of the Merced River confluence and areas above specific dams or above longstanding naturally impassable barriers.

IV. ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat, and ecosystem within the action area. When assessing the impacts of an ongoing project such as the Corps' operations of Englebright and Daguerre Point Dams on the Yuba River, the environmental baseline for that assessment includes all past impacts including the effects of the project up to the present day. The assessment of the future effects of the action (found in the following section of this document) will include all of the impacts to listed species and their habitat which will continue to occur from operations of the projects in the future. Many of the past project effects included in the environmental baseline section will continue to affect the species in the future and must therefore be included in the assessment of the effects of the action. Therefore, an in-depth and detailed analysis of these effects will be provided in the *Effects of the Action* section of this document, whereas a more general description of these effects will be provided in this *Environmental Baseline* section.

The action area for this project includes the active stream channels and riparian corridors of the Yuba River starting at and including Englebright Dam and Reservoir, downstream approximately 24 miles to the confluence with the Feather River, including Daguerre Point Dam and all water diversion facilities associated with the two dams.

Status of the Listed Species within the Action Area

Central Valley spring-run chinook salmon

The Central Valley spring-run chinook salmon is federally listed as threatened. The habitat for this species within the Yuba River is designated as critical habitat. Part of the significance of the Yuba River fishery is that it supports natural reproduction which is not augmented with hatchery transplants (McEwan et al., 1996), although DFG did conduct a one time stocking of a small number of juvenile spring-run from the Feather River Hatchery into the Lower Yuba River in 1980 (DFG 1991).

Little is known about the size of the remaining population of spring-run chinook salmon in the Lower Yuba River. Recent spawning surveys and adult monitoring at the fish ladders on Daguerre Point Dam conducted by DFG have detected a small remnant population of spring-run chinook salmon (fish that enter the river in spring and early summer and that begin spawning in early September), a preliminary analysis of the 2001 fish ladder trapping data produced a run size estimate of 108 spring-run chinook salmon with a 95% confidence interval from 52 to 164 spawners (DFG unpublished data). Additional spawning and carcass surveys conducted by private consultants funded by YCWA have likewise detected the persistence of spring-run chinook salmon in the Yuba River, although none of these reports provided population estimates specifically for spring-run salmon.

In general, the current data indicates that populations are very small and have been greatly reduced from historic levels. Historic accounts of spring-run populations on the Yuba River prior to the massive impacts caused by gold mining, dam construction and water diversions, show that large numbers of salmon were taken by miners and Indians as far up as Downieville on the Yuba, and that during the construction of the original Bullards Bar Dam (1921-1924) so many salmon congregated and died below the dam that they had to be burned (Yoshiyama et. al 1996).

Central Valley steelhead
The Central Valley steelhead is federally listed as threatened. The habitat for this species within the Yuba River is designated as critical habitat. Part of the significance of the Yuba River fishery is that it supports natural reproduction which is no longer augmented with hatchery transplants (McEwan et al., 1996). As with the spring-run chinook salmon, there has been very little information published on population trends and absolute abundance of steelhead in the Yuba River. It is known that the vast majority of spawning and rearing habitat for steelhead in the Yuba River was first impacted by gold mining activities and then totally cut off by Englebright Dam. Prior to construction of Englebright, fisheries biologists for DFG observed large numbers of steelhead spawning in the uppermost reaches of the Yuba River and its tributaries (DFG, 1998; Yoshiyama et. al 1996).

As steelhead have been heavily affected by mining operations and dam construction on the Yuba River since the 1800's, the steelhead population has likely been relatively small since that time. DFG estimated a spawning population of only about 200 fish annually prior to 1969. During the 1970's, DFG annually stocked hatchery steelhead from Coleman National Fish Hatchery into the lower Yuba River, and by 1975 estimated a run size of about 2,000 fish (DFG 1991). Since 1975, the run size has not been estimated, but is believed to be "stable" and supports a significant steelhead fishery. DFG stopped stocking trout into the Lower Yuba River in 1979, and currently manages the resource for natural steelhead production.

Factors Affecting Species Environment within the Action Area

The Yuba River Watershed is characterized by cool, wet winters with high flows, and hot dry summers with low summer and fall run-off. Within the upper watershed, variable winter rains and snow provide inflow into numerous reservoirs for storage which in turn affect water releases to the lower Yuba River. The lower Yuba River extends approximately 24 miles from Englebright Dam to its confluence with the Feather River. Two tributaries, Deer Creek and Dry Creek, enter the lower Yuba River at about River Mile (RM) 23 and RM 14, respectively. Based on general differences in hydraulic conditions, channel morphology, geology, water conditions, and fish species distribution, Beak (1989) divided the river into four reaches -- Narrows Reach, Garcia Gravel Pit Reach, Daguerre Point Dam Reach, and Simpson Lane Reach.

The Narrows Reach extends about two miles downstream from Englebright Dam. In this reach the channel is steep and consists of a series of rapids and deep pools confined by a bedrock canyon. Spring- and fall-run chinook salmon and steelhead can migrate as far as Englebright Dam, but spawning gravels are scarce in the Narrows Reach.

Downstream of the Narrows Reach, the channel enters the alluvial valley plain where massive quantities of hydraulic mining debris remain from past gold mining operations. The Garcia Gravel Pit and Daguerre Point Dam Reaches continue 18.5 miles to the downstream end of the Yuba Goldfields (RM 3.5) near Marysville. These reaches, which contain most of the chinook salmon and steelhead spawning and rearing habitat in the lower Yuba River, consist of alternating pools, runs, and riffles with predominantly cobble and gravel substrates. Daguerre Point Dam, located at RM 11.5, marks the boundary between the Garcia Gravel Pit and Daguerre Point Dam Reaches. The Garcia Gravel Pit Reach generally provides higher quality habitat than the Daguerre Point Dam Reach because of a greater development of bar complexes, side channels, and shaded riverine aquatic cover. The channel downstream of Daguerre Point Dam tends to be more uniform with a lower proportion of bar complexes and riffles. The lower 3.5 miles of the lower Yuba River (Simpson Lane Reach) are bordered by levees and are subject to the backwater influence of the Feather River. The streambed in this reach is dominated by finer-grain deposits and lower abundance of gravels and cobbles. Mature riparian vegetation is sparse and intermittent along the lower Yuba River, leaving much of the bank areas completly unshaded and lacking in large woody debris.

The essential features of freshwater salmonid habitat include adequate (1) substrate; (2) flow (water quantity, water velocity); (3) water temperature; (4) riparian habitat and instream structural diversity (cover or shelter, food, riparian shading); (5) safe passage conditions and; (6) habitat quality (water quality, effect of land-use activities). These features have been affected by human activities such as water impoundments, mining, water diversions, flood control and agriculture throughout the lower Yuba River. Impacts to essential habitat features have led to a reduction in salmonid populations within the Yuba River.

Gold Mining

A massive influx of sediment from hydraulic and dredge mining in the lower Yuba River during the late 1800s and early 1900s caused dramatic changes in channel course, geometry, and bed elevation. Since that time, the river has incised into the debris plain downstream of the Narrows Reach and has changed from an unstable, braided channel to a relatively stable, single-thread channel (Beak 1989). However, because the channel and floodplain are dominated by unconsolidated cobble and gravel substrates, high winter flows can result in active channel migration, especially in the Garcia Gravel Pit Reach.

Hydraulic mining practices during the late 1800s and early 1900s introduced vast quantities of silt and sediment to the river throughout much of the year, including the spawning and incubation periods for chinook salmon and steelhead. It is likely that these high turbidity levels were devastating to early life stages of salmonids as the fine sediments would have settled over incubating eggs and pre-emergent fry suffocating these fish. Gold mining also introduced mercury to the river as a waste product of the gold amalgamation process (Beak 1989). Mercury is extremely toxic in its methylated form.

Extensive dredger tailings occur along the lower Yuba River in an area known as the Yuba Goldfields. Past and ongoing gold dredging operations in this area have resulted in loss of fine-grained sediments and creation of porous and uniform deposits of cobbles and gravels. The Goldfields contain a network of dredger ponds and channels connected hydraulically by surface and subsurface flows. This area, along with other large areas of mining debris deposits along the lower Yuba River absorb and retain water during periods of high flows and/or precipitation and can release that water in the form of underflow that persists through the dry months and contributes to river flows through lateral accretion.

Upper River Impoundments

The upper basins of the North, Middle and South Yuba Rivers have been extensively developed for power, flood control and consumptive water use through the construction of multiple reservoirs and conveyance facilities. The largest reservoir by far is New Bullards Bar Reservoir on the North Yuba River. The New Bullards Bar Dam, a 645-foot high, 2,323-foot long, arch dam creates a 966,000 AF reservoir. The Colgate Powerhouse, which generates hydropower from releases out of New Bullards Bar Reservoir, is powered by up to 3,400 cfs at 1,300-foot head, by a 26-foot diameter, 4.7-mile long tunnel from the reservoir. The Colgate Powerhouse is generally run in a peaking mode using Englebright Reservoir as a regulating afterbay to provide consistent flows to the lower Yuba River. In addition to the Colgate Powerhouse, in 1986, YCWA constructed a 235 HP impulse turbine at the base of New Bullards Bar Dam to generate hydroelectric power from the releases that are required for instream flow in the reach between New Bullards Bar Dam and Colgate Powerhouse. The power intake for Colgate Powerhouse and the outlet at the base of New Bullards Bar Reservoir can take water from near the bottom of the reservoir to provide the coldest possible releases. This cold water from New Bullards Bar Reservoir is maintained to a large extent through Englebright Reservoir to provide benefits to the salmonid fisheries in the lower Yuba River.

Associated with New Bullards Bar Reservoir are the Our House and Log Cabin Diversion Dams. The 75-foot high Our House Diversion Dam on the Middle Yuba River diverts water through the 3.8-mile Lohman Ridge Tunnel to Oregon Creek near Camptonville. The 55-foot high Log Cabin Diversion Dam on Oregon Creek then diverts the water brought from the Middle Yuba River, as well as Oregon Creek water, through the 1.2-mile Camptonville Tunnel into New Bullards Bar Reservoir. The Camptonville tunnel capacity is 1,200 cfs. These facilities are owned and operated by YCWA.

Various water districts, irrigation districts, water companies and individuals contract with YCWA for delivery of Yuba River water. The YCWA water rights include the right to directly divert a total of 1,550 cfs for irrigation and other uses, and to divert a total of 960,000 AF to storage from October 1 to June 30 in New Bullards Bar Reservoir for subsequent irrigation and other uses (SWRCB 1994). Under an existing power purchase agreement between PG&E and YCWA, PG&E can require the release of water from New Bullards Bar Reservoir for power generation based on monthly quotas and available storage in the reservoir above an established index or "critical level."

The Middle and South Yuba Rivers have also been extensively developed with many small and medium sized reservoirs and an intricate network of interconnecting canals and aqueducts. The majority of these facilities are owned and operated by Nevada Irrigation District (NID) and PG&E. In addition to some consumptive use of this water within the Yuba River basin, these entities export an average of approximately 410,000 AF per year out of the Yuba River Basin to the Bear and American River Basins. Additionally, the Oroville Wyandotte Irrigation District (OWID) exports an average of about 71,000 AF per year from Slate Creek (a tributary to the North Yuba River) to the Feather River Basin.

All of these upper basin reservoirs and diversions capture the first increment of the available water supply, and thus can have a substantial impact on the supply available for release to the lower Yuba River, particularly during dry and critical years (SWRCB 2000 Hearing Exhibit S-YCWA 13). The combined process of filling, pooling, and emptying of New Bullards Bar and the other upstream reservoirs alters the natural timing, frequency, duration, quantity and temperature of water flowing from the upper basin downstream to the last remaining habitat for listed salmonids in the lower Yuba River. Some of these alterations in the natural flow and temperature regime improve certain habitat elements over what was historically found in this low elevation reach of the lower Yuba River. Improvements include reductions in summer and fall water temperatures, attenuation of high flood events that could otherwise result in scouring of salmon and steelhead redds, and increased summer flow rates providing year-round rearing habitat for salmon and steelhead. The alteration of the natural flow regime can also have adverse affects on salmonids including disrupting the cues used by these fish to determine timing of adult upstream migration and spawning as well as juvenile out-migration and rearing habitat selection.

In addition to the direct effects on the fisheries, the altered hydrological flow regime affects the natural meandering of the river and the downstream fluvial process of transporting nutrients needed to establish important shaded riverine aquatic (SRA) habitat in the flood plain. The reduction of peak flows in the late winter and spring results in a reduction in regeneration of riparian vegetation which would otherwise provide SRA habitat for salmon and steelhead below Englebright Dam. Willow and cottonwood regeneration and seed dispersal is more prominent under natural flow regimes where there is variation in how much of the flood plain becomes wetted, especially in May and June, to create different age classes and promote seed germination. The result of this altered hydrology and geomorphology is that habitat for fry and juvenile salmon in the lower Yuba River is currently rated less than optimum (DFG, 1991).

<u>Englebright Dam</u>

The construction of Englebright Dam in 1941 blocked access by anadromous salmonids to all of the high elevation, cold water habitat above the dam including all three forks and the many small tributaries which make up the upper watershed. Operation of Englebright Reservoir, including the storage and subsequent release of water, altered the natural flow regime by which juvenile and adult salmonids based their migrations. The construction of Englebright Dam also upset the natural geofluvial process resulting in decreased recruitment of gravel and large woody debris. The elimination of upstream access coupled with the downstream impacts greatly reduced the capacity of the Yuba River to maintain healthy, stable populations of spring-run chinook salmon and steelhead.

Riparian Vegetation

Large woody debris, SRA and other components a healthy riparian corridor are important features for the health and survival of riverine salmonids. Juvenile salmonids depend on such habitat for resting and avoidance of predators as well as the food source provided by the many aquatic invertebrates associated with this vegetative material. Healthy riparian cover also helps to shade the stream, providing cooler water temperatures and cover for adults.

The deposition of hydraulic mining debris, subsequent dredge mining, and loss/confinement of the active river corridor and floodplain of the lower Yuba River since the mid-1800s has eliminated much of the riparian vegetation along the lower Yuba River. In addition, the large quantities of cobble and gravel that remained generally provided poor conditions for re-establishment and growth of riparian vegetation. Construction of Englebright Dam also inhibited regeneration of riparian vegetation by preventing the transport of any new fine sediment, woody debris, and nutrients from upstream sources to the lower river. Subsequently, mature riparian vegetation is sparse and intermittent along the lower Yuba River, leaving much of the bank areas unshaded and lacking in large woody debris. This loss of riparian cover has greatly diminished the value of critical habitat in this area, thereby reducing the survivability of listed salmonids in the Lower Yuba River

Instream Flows

The operation of the Yuba River Development Project (YRDP) including flow requirements from Englebright Reservoir is subject to provisions of various permits, licenses and contracts, including water right permits and licenses administered by the State Water Resources Control Board (SWRCB), Federal Power Act License 2246, the 1966 Power Purchase Contract with PG&E, a 1965 contract with CDFG concerning instream flows, and a 1966 contract with the DWR under the Davis-Grunsky Act (SWRCB 1992 Hearing Exhibit YCWA 20, pp. 3 and 4). YCWA determines project operations based on year-to-year analyses (SWRCB 1992 Hearing Transcript VII, 132:13-132:14).

In 1962, YCWA entered into an agreement with DFG to provide the following minimum instream flows for normal water years for preserving and enhancing the fish resources in areas below Daguerre Point Dam:

1. October through December - 400 cfs
2. January through June - 245 cfs
3. July through September - 70 cfs

Releases required by the agreement were subject to reductions in critical dry years, which are defined as those years for which the DWR April 1 forecast predicts that annual unimpaired flow in the lower Yuba River at Smartville will be 50 percent or less of normal. The water release curtailments for critical dry years include reductions of 15, 20, and 30 percent when Yuba River unimpaired flow forecasts are 50, 45, and 40 percent or less of normal, respectively. The critical year provision was effective from the time of the forecast until April 1 of the following year. However, in no event were flows to be reduced to less than 70 cfs

(SWRCB 1992 Hearing Exhibit DFG-26, pp. 187-188). YCWA's Federal Power Act license also contains these requirements. In most years, the YCWA has voluntarily exceeded the 1962 minimum flow requirements

The flow regime which has resulted from this very minimal requirement for instream flows often produces water temperatures and habitat conditions which are well below the optimal preferred ranges for salmonids. In 1991, DFG released a Fisheries Management Plan for the Yuba River which contained revised recommendations for minimum instream flows based on studies on the relationship between usable fish habitat and discharge. The methodologies used were IFIM (Instream Flow Incremental Methodology) and SNTEMP (Stream Network Temperature Model) modeling. Management needs for multiple species including spring-run salmon, steelhead, and shad were incorporated into the modeling. A new flow schedule was developed for the Marysville gage. The minimum recommended flows follow:

1. October 15 to March 31 - 700 cfs
2. April 1 to April 30 - 1,000 cfs
3. May 1 to May 31 - 2,000 cfs
4. June 1 to June 30 - 1,500 cfs
5. July 1 to October 14 - 450 cfs

During dry years, the DFG recommended that the flows between Englebright Dam and the confluence of the Feather River and agricultural diversions associated with Daguerre Point Dam be reduced on an equal percentage basis.

These flow recommendations were not adopted by YCWA.

On February 23, 1988 the SWRCB received a complaint filed by a coalition of fishery groups referred to as the United Groups regarding fishery protection and water rights issues on the lower Yuba River. In 1992 and again in 2000, the SWRCB held hearings to receive testimony and other evidence regarding fishery issues in the lower Yuba River and other issues raised in the United Groups complaint.

On March 1, 2001, the SWRCB issued its final decision (D-1644) regarding the protection of fishery resources and other issues relating to diversion and use of water from the lower Yuba River. Among other requirements, D-1644 specified new minimum flow requirements and flow fluctuation criteria for the lower Yuba River. Although these minimum flow requirements did not provide the flow protection recommended by DFG, NMFS or FWS, according to D-1644 (pp. 48-49), these flows were developed to enhance habitat for adult attraction and passage, spawning, egg incubation, juvenile rearing and emigration of chinook salmon, steelhead, and American shad in the lower Yuba River.

Minimum instream flow requirements specified in D-1644 include both interim and long-term requirements for specified periods by water-year types (see Tables 1 and 2). D-1644 specifies that the long-term instream flow requirements will come into effect on April 21, 2006. One important difference between the interim and long-term flow requirements is the minimum flows specified for late April, May and June of dry and critical years. During late April, May and June of dry and critical years, minimum flows under the interim requirements will be lower than those under the long-term requirements.

Table 1. Interim instream flow requirements.

Period	Wet & Above Normal Years (cfs)		Below Normal Years (cfs)		Dry Years (cfs)		Critical Years (cfs)	
	Smartville Gage	Marysville Gage	Smartville Gage	Marysville Gage	Smartville Gage	Marysville Gage	Smartville Gage	Marysville Gage
Sep 15-Oct 14	700	250	550	250	500	250	400	150
Oct 15-Apr 20	700	500	700	500	600	400	400	250
Apr 21-Apr 30	--	1,000	--	900	--	400	600	400
May 1-May 31	--	1,500	--	1,500	--	500	--	280
Jun 1	--	1,050	--	1,050	--	400	--	270
Jun 2-Jun 30	--	800	--	800	--	400	--	270
Jul 1	--	560	--	560	--	280	--	(see
Jul 2	--	390	--	390	--	250	--	note)
Jul 3-Sep 14	--	250	--	250	--	250	--	100

Table Note: The interim instream flow requirements for June 1-30 of critical years shall be 245 cfs pursuant to the provisions of the agreement between YCWA and CDFG dated September 2, 1965, except if a lower flow is allowed pursuant to the provisions of the 1965 agreement. The minimum flow on July 1 shall be 70 percent of the flow on June 30, and the minimum flow on July 2 shall be 70 percent of the flow on July 1. (Source: D-1644, pg. 175.)

Table 2. Long-Term instream flow requirements.

Periods	Wet, Above, Normal, & Below Normal Years (cfs)		Dry years (cfs)		Critical Years (cfs)		Extreme Critical Years* (cfs)	
	Smartville Gage	Marysville Gage	Smartville Gage	Marysville Gage	Smartville Gage	Marysville Gage	Smartville Gage	Marysville Gage
Sept. 15-Oct. 14	700	250	500	250	400	250	400	250
Oct. 15-Apr. 20	700	500	600	400	600	400	600	400
Apr 21-Apr 30	--	1,000	--	1,000	--	1,000	--	500
May 1-May 31	--	1,500	--	1,500	--	1,100	--	500
June 1	--	1,050	--	1,050	--	800	--	500
June 2	--	800	--	800	--	800	--	500
June 3-June 30	--	800	--	800	--	800	--	500
July 1	--	560	--	560	--	560	--	500
July 2	--	390	--	390	--	390	--	390
July 3-Sept. 14	--	250	--	250	--	250	--	250

* "Extreme Critical" year classification is defined as: Equal to or less than 540 TAF on the Yuba River Index scale. (Source: D-1644)

Flow Fluctuations

Flow reductions resulting from normal maintenance and emergency operations of the Narrows I and II powerhouses have been a major concern in recent years because of potential adverse flow and temperature effects on listed spring-run chinook salmon and steelhead. The ability to manage releases from Englebright Dam during maintenance and emergency operations is limited by the design of Englebright Dam and the bypass capability of the Narrows I and Narrows II powerhouses. The only way to pass water from Englebright Reservoir downstream is to discharge water through the Narrows I and Narrows II powerhouses, or to spill water over the top of the dam. Because Englebright Dam was originally designed as a debris dam, there is no other outlet on the dam to bypass water. Currently, Narrows I can bypass the maximum generating capacity of the plant (650 cfs) in the event of a shut-down. Narrows II has a maximum generating capacity of 3,400 cfs and a bypass capability of only 650 cfs.

YCWA and PG&E currently coordinate the operation of Narrows I and Narrows II for hydropower efficiency and flow stability in the lower Yuba River. Both powerhouses are operated as base-load plants and are dependent on available storage in New Bullards Bar and Englebright Reservoirs. Under current operating procedures, only Narrows I is operated when total releases from Englebright Dam are 730 cfs or less. When releases are 730 to 2,560 cfs, generally only Narrows II is operated. When releases exceed 2,560 cfs, both powerhouses generally operate. During water years 1970 through 1990, FERC (1992) estimated that daily average flows of 730 and 2,560 cfs were exceeded 74.4 percent and 33.4 percent of the time, respectively. These estimates indicate that Narrows II operates alone up to 41 percent of the time, and together with Narrows I up to 33.4 percent of the time, for a total of up to 74.4 percent of the time.

Maintenance activities at Narrows II include generator brush replacement, which requires a 6-hour shut-down 2-3 times per year, and annual maintenance, which typically requires a 2-3-week shut-down but can be longer if major maintenance is needed. During brush replacement, the 650 cfs bypass valve at Narrows II can be opened. During annual maintenance, the Narrows II bypass valve usually cannot be operated, and Narrows I is used to maintain instream flows. Consequently, flows in the river must be reduced to a maximum of 650 cfs for several days to several weeks, depending on the type of maintenance. Since 1991, YCWA has scheduled annual maintenance activities during periods when the potential for redd dewatering and fish stranding is lowest (late August to mid-September), as determined by redd and fish stranding surveys. In recent years, YCWA and PG&E have, in cooperation with the resource agencies, modified operations and maintenance schedules to further protect spring-run chinook salmon and steelhead redds and juveniles from flow and temperature impacts associated with planned flow reductions.

Since 1998, there have been nine uncontrolled Narrows II flow events resulting in sustained flow reductions. Seven of these events were caused by PG&E-maintained systems. This includes six electric transmission line outages on the PG&E's transmission line connecting the YCWA Narrows II Powerhouse to the electric grid, and one on the transfer trip relay. The two other events were caused by Narrows II plant systems. Three of these nine events were in 1998, five in 1999 and one in 2000. The number of events in 1998 and 1999 are abnormally high, compared to long-term averages. Below is summary of some of the recent flow reduction events that have had potential to cause redd dewatering, stranding of fish and/or elevated temperatures:

February 9, 1999 – An excess Narrows II generator bearing temperature indication tripped Narrows II offline. At the time, a rainstorm created substantial spill of about 11,350 cfs at Englebright Dam. The Yuba River flow below the powerhouses dropped from about 15,033 cfs to about 12,954 cfs, and then increased to about 20,474 cfs, with the total event lasting about 4 hours. The higher ending flow was due to the increased spill over Englebright Dam due to the storm event.

February 16, 1999 – A PG&E transmission line outage, caused by a bird, tripped Narrows II offline. At the time, Englebright Dam was spilling and the Yuba River flow below the powerhouses dropped from about 4,292 cfs to about 1,461 cfs and then increased to about 4,824 cfs, with the event lasting about 4 hours.

March 9, 1999 – A PG&E transmission line outage, the cause of which was not identified, caused Narrows II to trip offline. The Yuba River flow below the powerhouses dropped from about 4,577 cfs to about 3,315 cfs, and then increased to about 4,439 cfs, with the event lasting less than 30 minutes.

September 12, 2000 – A PG&E transmission line outage, caused by a bird, tripped Narrows II offline. The Yuba River flow below the powerhouses dropped from about 1,060 cfs to about 310 cfs, and then increased to about 1,051 cfs, with the event lasting about 2 hours. At the time of the event, Narrows II was under PG&E Wise Switching Center control and confusion over the Supervisory Control And Data Acquisition data extended the flow reduction by about 1.5 hours.

Uncontrolled flow reductions due to unexpected outages at Narrows II have produced extensive impacts including stranding of juvenile and adult fish, dewatering of spawning areas and other critical habitat, and elevation of water temperatures. Under the current project configuration these flow reductions may continue to occur in the future (FERC 2001).

Daguerre Point Dam

Since it's construction in 1906, Daguerre Point Dam has caused varying degrees of fish passage problems. For many years, there were no functional ladders and the dam was a total barrier to upstream migration, which likely decimated anadromous fish populations on the Yuba River as there was very little suitable spawning habitat below the dam (CDFG 1991). Fish passage was improved with the installation of new ladders in 1950, but is still considered inadequate for chinook salmon and steelhead throughout much of the year. Under current conditions, adult fish passage is severely impaired when major runoff events create high flow conditions at the dam, which is often the same period when spring-run salmon and steelhead are attempting to migrate upstream to their spawning areas. This passage problem may lead to injury, delayed migration, and/or pre-spawning mortality. The angle of the entrance orifices and proximity to the plunge pool also make it difficult for fish to find the entrances to the ladders.

Upstream passage at Daguerre Point Dam has also occasionally been adversely impacted when sediment has built up near the upstream exit of the fish ladders. Normal geofluvial action has, in the past, caused gravel to build up on the upstream side of the dam where it can impede flows into the ladders, thereby reducing the ability of fish to climb the ladders and reducing the attraction flow coming out at the base of the ladders. In addition, the gravel bars have built up to the point where they greatly reduce access to the main channel for fish that have exited at the top of the ladders and are attempting to continue their upstream migration.

Juvenile salmonids have also been adversely affected by Daguerre Point Dam on their downstream migration. The large plunge pool at the base of the dam creates an area of unnatural advantage for predatory fish such as Sacramento pikeminnow *(Ptychocheilus grandis)*, large mouth bass (*Micropterus salmoides*), striped bass (*Morone saxatalis*), American shad (*Alosa sapidissima*) and adult rainbow trout/steelhead which reside or seasonally inhabit this section of the Yuba River. The deep pool provides excellent ambush habitat for predators in an area where juvenile salmonids can be disoriented after plunging over the face of the dam into the turbulent waters at the base, making them highly vulnerable to predation.

Water Diversions

There are three significant water diversions associated with Daguerre Point Dam that have a combined diversion capacity of 1,085 CFS. For many years these diversions were completly unscreened, allowing large numbers of juvenile salmonids to be entrained into the canals where they faced near certain mortality. The three diversions include the Brown's Valley Diversion, the South Yuba-Brophy diversion and the Hallwood-Cordua diversion. Recent efforts to reduce the loss of juvenile salmonids at these diversions has led to the construction of fish exclusionary devices at each diversion. These devices range from fully compliant positive barrier fish screens to a porous rock weir which fails to meet many of the criteria set forth by NMFS in their Fish Screening Criteria for Anadromous Salmonids. A more detailed description of the diversions and their impacts to salmonids can be found in the *Effects of the Action* section of this document.

Predation

The introduction of non-native predatory fish to the lower Yuba River has caused an increase in predation impacts on salmonids in this system. Striped bass, American shad, and large and small mouth bass (*Micropterus dolomieu*) are some of the non-native species which have been introduced to the Yuba River and which have been shown to prey on juvenile salmonids. In addition to these introduced species there are several native fishes which also prey on juvenile salmonids, such as Sacramento pikeminnow, hardhead (*Mylopharodon conocephalus*) and adult rainbow trout/steelhead.

Englebright and Daguerre Point Dams exacerbate the impacts of predation on juvenile salmonids in the Yuba River. Englebright Dam completly blocks access to the cold water habitat in the upper basin where temperature conditions are inhospitable to warm water predators such as bass and pikeminnow and where juvenile salmonids could otherwise hatch and rear in areas relatively free of these predators. Daguerre Point dam, as discussed above, tips the natural balance in the favor of the predators by creating an unnatural condition below the dam where predators are provided excellent ambush habitat in an area where juvenile salmonids are disoriented after plunging over the face of the dam into the deep pool below.

Angling and Poaching

Angling regulations on the lower Yuba River are intended to protect sensitive species, but under current regulations, anglers are permitted to keep and kill chinook salmon during the time period when threatened spring-run chinook are likely to be in the river and are therefore susceptible to take. Additionally, there is the added potential for anglers to harm, harass and kill listed species through incidental catch while targeting non-listed species. There is also the potential for anglers to disrupt spawning fish and redds by wading through spawning areas while in pursuit of legal quarry.

Poaching of salmon has been a long standing problem on the Yuba River, particularly at Daguerre Point Dam (John Nelson, DFG, pers. com. 2000). Poaching within the fish ladders and downstream of the dam occurs when fish become concentrated in the area due to delayed passage. The greatest number of poached fish are likely fall-run salmon as they are by far the largest run on the river. However, since the spring-run salmon are in the river during the period of highest recreational use (spring and summer), there is a greater potential for people to encounter these fish and because the current population is very small, the loss of any pre-spawned adults could cause a significant adverse impact.

Riparian Vegetation

Deposition of hydraulic mining debris, subsequent dredge mining, and loss/confinement of the active river corridor and floodplain of the lower Yuba River since the mid-1800s eliminated much of the riparian vegetation along the lower Yuba River. In addition, the large quantities of cobble and gravel that remained generally provided poor conditions for re-establishment and growth of riparian vegetation. Construction of Englebright Dam has also inhibited regeneration of riparian vegetation by preventing the transport of any new fine sediment, woody debris, and nutrients from upstream sources to the lower river. Subsequently, mature riparian vegetation is sparse and intermittent along the lower Yuba River, leaving much of the bank areas unshaded and lacking in large woody debris. Juvenile salmonids depend on such habitat for resting and avoidance of predators as well as the food source provided by the many aquatic invertebrates associated with this vegetative material. Healthy riparian cover also helps to shade the stream, providing cooler water temperatures and cover for both juveniles and adults. The loss of riparian cover has greatly diminished the value of critical habitat in this area, possibly reducing the survival of listed salmonids in the Lower Yuba River.

V. EFFECTS OF THE ACTION

In determining the effects of an ongoing action, the ESA requires NMFS to assess all of the impacts to listed species and their habitat which will result from the continued operation of the project into the future. Typically, the effects of past operations are described in the ENVIRONMENTAL BASELINE section of the Opinion. NMFS adds the effects of the proposed action and cumulative effects to this baseline to determine if the proposed action is likely to jeopardize the continued existence of listed species or destroy or adversely modify critical habitat. However, to avoid repetitive discussion of the effects of past and future operations of the dams and associated facilities, NMFS has described the past effects and expected future effects of the proposed action together below.

Englebright Dam

Englebright Dam blocks access by anadromous salmonids to all of the high elevation, cold water habitat above the dam, including all three forks of the Yuba River and the many small tributaries which make up the upper watershed. Operation of Englebright Reservoir, including the storage and subsequent release of water, alters the natural flow regime by which juvenile and adult salmonids base their migrations. This altered flow regime also upsets the natural hydrological process resulting in decreased recruitment of gravel and large woody debris into the lower river. The lack of upstream access coupled with the downstream impacts greatly reduces the capacity of the Yuba River to maintain healthy, stable populations of spring-run chinook salmon and steelhead.

Englebright Dam also forces overlapping use of the same spawning areas by spring- and fall-run chinook salmon. Spring-run salmon move into spawning streams in the spring, hold over the summer in deep, cold-water pools, and then spawn in the late summer beginning in early to mid-September (Campbell and Moyle, 1990). Under natural conditions spring-run would take advantage of high spring runoff conditions to migrate into the uppermost reaches of the Yuba watershed where they would spawn in areas spatially separated from the fall run fish. The fall-run fish enter the river later in the year and are generally unable to reach the upper reaches due to low flow conditions and their need to spawn shortly after entering fresh water. These divergent life history strategies are what have separated the two runs of chinook salmon creating distinctive genotypic and phenotypic characteristics between the two. The existence of Englebright Dam blocks the migration of spring-run fish, forcing them to remain in the lower river where fall-run fish can "catch up" to them and spawn in the same areas. While fall-run fish generally begin spawning a little later than spring-run fish (starting in early October), there can be some overlap in timing, causing the two races to interbreed and dilute the genetics of the less abundant spring-run. There is also the potential, in areas heavily used by spawning fall-run fish, for the later spawning fall-run to superimpose their redds onto previously laid spring-run redds thereby disrupting the spring-run redds and reducing the survival of those eggs.

Another adverse effect of Englebright Dam is that it forces fish to spawn in a limited area without the benefit of smaller tributaries which can provide some level of refuge in the event of catastrophic events such as chemical spills or massive flood events. A chemical spill in the upper Sacramento River above Lake Shasta, California, decimated the trout fishery, but this fishery has shown significant recovery due in part to the many fish that were able to escape into smaller tributaries and Lake Shasta to avoid the effects of the spill. The two tributaries that remain accessible to salmonids on the lower Yuba River are small, and one has a barrier near the mouth that prevents upstream access under most flow conditions. Major catastrophic events are rare, but have the potential to occur in any given year. The federally listed species of the Yuba River are especially vulnerable to these events as their low population numbers and long periods of residency in the river increase the potential for a catastrophic event to significantly reduce or completely decimate their populations.

Englebright Dam also inhibits regeneration of riparian vegetation and critical SRA habitat by preventing the transport of fine sediment, woody debris, and nutrients from upstream sources to the lower river. Subsequently, mature riparian vegetation is sparse and intermittent along the lower Yuba River, leaving much of the bank areas unshaded and lacking in large woody debris. Juvenile salmonids depend on such habitat for resting and avoidance of predators as well as the food source provided by the many aquatic invertebrates associated with this vegetative material. Healthy riparian cover also helps to shade the stream, providing cooler water temperatures and cover for both juveniles and adults. The loss of riparian cover has greatly diminished the value of critical habitat in this area, possibly reducing the survival of listed salmonids in the Lower Yuba River.

<u>Flow Fluctuations</u>

The Narrows II power plant has a maximum generating capacity of 3,400 cfs and a bypass capability of only 650 cfs. This design leaves the potential for a major drop in flows (up to 2,750 cfs drop) if a shut down becomes necessary while the plant is at maximum capacity. Emergency shut downs in the past have resulted in flows temporarily (up to 2 hours) dropping below 650 cfs due to delays in the activation of the bypass mechanism. The Narrows I power plant has the capability of full bypass of the maximum generating capacity of the plant (650 cfs) in the event of a shut-down. Therefore, the only potential for a significant drop in flows due to Narrow I operations would be a failure or delay in the activation of the bypass mechanism. Large scale, prolonged reductions in flows out of Englebright Dam resulting from normal maintenance or emergency operations of the Narrows I and II powerhouses have the potential to cause significant adverse effects to listed salmonids such as stranding of juvenile and adult fish, dewatering of spawning areas and other critical habitat, and elevated water temperatures.

Maintenance activities at Narrows II include generator brush replacement, which requires a 6-hour shut-down 2-3 times per year, and annual maintenance, which typically requires a 2-3-week shut-down but can be longer if major maintenance is needed. During brush replacement, the 650 cfs bypass valve at Narrows II can be opened. During annual maintenance, the Narrows II bypass valve usually cannot be operated, and Narrows I is used to maintain instream flows. Consequently, flows in the river must be reduced to a maximum of 650 cfs for several days to several weeks, depending on the type of maintenance. In general, YCWA and PG&E, in coordination with the resource agencies, are able to schedule maintenance activities during periods which will minimize impacts to spring-run chinook salmon and steelhead redds and juveniles from flow and temperature impacts associated with flow reductions.

Uncontrolled flow reductions due to unexpected outages at Narrows II have the greatest potential for adverse effects on listed steelhead and spring-run chinook salmon. Such events occur quickly, with no controlled ramping rates and have lasted anywhere from a few minutes to several hours. These uncontrolled flow reductions have the potential to cause mortality of eggs and pre emergent fry from dewatering of redds when river levels drop. Free swimming juveniles and adults also have the potential to become stranded or isolated from the main channel due to quickly receding water levels. The severity of impacts to listed salmonids from any such event would depend on the timing and magnitude of the event. Under worst case scenarios, a prolonged, large scale drop in flows could decimate an entire year class of a listed species in the lower Yuba River.

Minimum flow requirements

On March 1, 2001, the SWRCB issued its final decision (D-1644) regarding the protection of fishery resources and other issues relating to diversion and use of water from the lower Yuba River. Among other requirements, D-1644 specified new minimum flow requirements and flow fluctuation criteria for the lower Yuba River. These flow requirements are described in detail in the preceding Environmental Baseline section of this opinion. Through their testimony at the SWRCB hearings and comments submitted on preliminary drafts of the decision, NMFS, DFG and FWS, provided expert biological information showing that the minimum flows adopted by the SWRCB in D-1644 are insufficient to insure that water temperatures and other habitat conditions within the lower Yuba River will remain suitable for all life stages of listed salmonids in the river, especially in dry and critical years.

One risk to listed salmonids associated with insufficient flows is the potential for elevated water temperatures which have been shown to cause many adverse effects on the various life stages of chinook salmon. The most definitive data on the effects of elevated water temperatures on adult chinook salmon are related to critical thresholds affecting acute mortality and disease outbreaks, both in hatcheries and in the wild. The deteriorating physiological condition of Pacific salmon upon their seasonal maturation and upstream spawning migration render them vulnerable to environmental stressors, such as elevated water temperature. Opportunistic pathogens can gain advantage over the salmon's natural immunological defenses, resulting in disease. Elevated water temperatures can impose metabolic and physiological stresses, which can impair immunological functions in salmonids and increase their susceptibility to disease. The stress that can be caused by exposure to elevated water temperatures in adult chinook salmon may exacerbate the already-compromised immune system that results from the dramatic physiological stresses associated with re-entering freshwater and final sexual maturation (Marine 1997).

Bioenergetic optimization through selection of cooler water temperatures is clearly important to pre-spawning chinook salmon, as shown by Berman and Quinn (1991). Berman and Quinn (1991) demonstrated a pattern of behavioral thermoregulation for pre-spawning Yakima River spring-run chinook salmon. In this study, adult salmon outfitted with temperature sensitive radio transmitters consistently sought out cooler thermal refuges during the pre-spawning period, and maintained an average internal body temperature that was 4.5°F below ambient river temperature. This behavioral thermoregulation accounted for an estimated energetic savings of 12 to 20 percent. In the absence of such cool thermal refuges, bioenergetic expenditures are increased causing a potential reduction in survival and reproductive success for adult salmon.

The earliest life stages (eggs and pre-emergent fry) are often the most sensitive to elevated water temperatures. Seymour (1956) found that, at incubation temperatures of 34°F or 65°F, no eggs survived to hatching, and at constant 60°F and 62.5°F eggs hatched but none survived through the yolk-sac stage. Also, at constant temperatures of 55°F and 57.5°F, hatching had a high success, but mortality increased to 50 percent or greater during the yolk-sac stage. In a recent experiment conducted by the USFWS (1999), the latent effect of early-life temperature exposure observed in their experiment on fall-run chinook salmon showed increased mortality consistent with previous studies. USFWS (1999) suggests several mechanisms for latent mortality, including embryo development and differentiation being altered by elevated temperatures, and yolk coagulation resulting in poor absorption. Heming (1982) reported faster yolk absorption and lower conversion efficiency as temperature increased. According to the expert testimony provided by NMFS, DFG, and FWS at the State Water Board hearings, the water temperatures which occur under the current minimum flow regime do at times, exceed these temperature thresholds during the spawning and incubation period for spring-run chinook salmon. Exceedence of these temperature thresholds are likely to cause some or all of the above mentioned adverse effects on incubating eggs and pre emergent fry, thereby reducing the size and health of the juvenile cohort exposed to such temperatures.

Daguerre Point Dam

<u>Fish Passage</u>

Adult fish passage at Daguerre Point Dam is considered inadequate for chinook salmon and steelhead throughout much of the year (CDFG 1991). Adult fish passage is severely impaired during high flow conditions at the dam, which often occur during the period when spring-run salmon and steelhead are attempting to migrate upstream to their spawning areas. Throughout winter and spring when flows are high, adult fish experience difficulty in finding the entrance to the ladders because of the very small percentage of attraction flows coming out of the ladders compared to the massive sheetflow coming over the rest of the dam. The angle of the orifices and proximity to the plunge pool also increase the difficulty for fish to find the entrances to the ladders. Other design deficiencies which have been identified include periodic obstruction of the ladders by woody debris, operating criteria that require closure of the ladders at high flows, and the proximity and orientation of the ladder entrances to the spillway (CDFG 1991; USFWS 1994). Large schools of adult salmon have been observed congregating in the plunge pool below the dam and leaping at the face of the dam, indicating that migrating adults may not readily find the entrances to the fish ladders. This lack of free passage may lead to injury, delayed migration, increased depletion of precious energy reserves and/or pre-spawning mortality.

Upstream passage at Daguerre Point Dam may also be adversely impacted if sediment builds up near the upstream exit of the fish ladders. Normal geofluvial action has, in the past, caused gravel to build up on the upstream side of the dam where it can impede flows into the ladders, thereby reducing the ability of fish to climb the ladders and reducing the attraction flow coming out at the base of the ladders. In addition, the gravel bars can built up to the point where they greatly reduce access to the main channel for fish that have exited at the top of the ladders and are attempting to continue their upstream migration. Again, the prolonged delay in passage and the excess energy expended in attempting to pass the dam may result in reduced spawning success and/or pre spawning mortality of adults. The Corps, in their project description, stated an intent to develop a long term sediment management program to address this problem, although no actions have been taken to date towards the development of such a program. We are therefore unable to assess the possible effectiveness of such a program.

Juvenile salmonids can also be adversely affected by Daguerre Point Dam on their downstream migration. The large plunge pool at the base of the dam creates an area of unnatural advantage for predatory fish such as Sacramento pikeminnow, large mouth bass , striped bass, American shad and adult rainbow trout/steelhead which seasonally inhabit this section of the Yuba River. The deep pool provides excellent ambush habitat for predators in an area where juvenile salmonids can be disoriented or injured as they plunge over the face of the dam into the turbulent waters at the base, making them highly vulnerable to predation. This unnatural advantage for predators increases the overall level of predation on juvenile salmonids, thereby reducing the abundance of the juvenile cohort emigrating to the ocean.

Water Diversions

There are three significant water diversions associated with Daguerre Point Dam that have a combined diversion capacity of 1,085 CFS. The three diversions include the South Yuba-Brophy diversion, the Hallwood-Cordua diversion and the Brown's Valley diversion,.

The South Yuba-Brophy diversion facility includes a 450-foot long porous rock weir fitted with a fine-mesh barrier within the weir. This device was intended to protect fish from the impacts of the diversion but it fails to meet many of the critical criteria developed by NMFS and DFG for adequate fish screen operation and fish safety.

The interstitial spaces between the rocks making up this weir are much larger than the required 3/32 inches defined in the NMFS Fish Screening Criteria for Anadromous Salmonids. There is a fine meshed fabric buried within the weir which may meet the opening size criteria (if it is still intact) but there is obviously no sweeping flow along the face of this fabric inside of the weir and therefore any fry which encounter this mesh, instead of being swept along the face of the fabric, would be more likely to become impinged on the fabric and perish.

Sweeping flows along the face of the weir are often minimal and occasionally non-existent. By agreement with the DFG, at least 10 percent of the water diverted from the Yuba River must bypass the weir structure. The stipulated 10 percent bypass flow is not always met (FWS 1990) and at times there has been no bypass flow at all with the outlet channel running completly dry (John Nelson, DFG, pers. com. 2001).

Another feature of the diversion intake area that is detrimental to juvenile salmonids is the large, slow water pool that occurs within the intake canal directly in front of the porous rock weir. One problem with this pool is it's effect on flow velocity along the face of the rock weir. As water flows from the intake channel into this pool, the flow velocity slows considerably, reducing the sweeping flows along the face of the weir, which in turn increases the exposure time of any juvenile fish passing in front of the weir. Increased exposure time to the face of the weir increases the potential for those fish to be impinged into the weir. Another problem with this pool is it's attractiveness to large predatory fish. The pool's deep slow waters provide excellent holding and ambush habitat for large predatory fish such as Sacramento pikeminnow. On two separate occasions in the later summer of 2001, NMFS and DFG biologists have observed large schools of 20 to 30 pikeminnow actively feeding within this pool.

There have been several studies which have shown that the porous rock weir on the South Yuba-Brophy diversion does not exclude juvenile salmonids from being entrained into this diversion. On several occasions, fishery biologists have captured juvenile salmonids that were entrained behind the barrier either by passing through the weir or being washed over the top during high flows (USFWS 1990, Demko and Cramer 1994).

A mark recapture study conducted by DFG in May of 1988 found that approximately 50% of a sample of juvenile salmon that were released at the top of the intake channel were never recaptured below the diversion weir in the outflow bypass channel (Konnoff 1988). It is possible that some of those fish escaped the diversion without being captured in the two fike nets which spanned the outflow channel, but even so, this data provides a strong indication that fish are being lost at this diversion.

The continuation of current operations at the South Yuba-Brophy diversion is likely to cause a reduction in survival of juvenile steelhead and spring-run chinook due to entrainment and increased predation at the diversion headworks.

In the spring of 2000 the fish screen on the Hallwood-Cordua diversion was rebuilt by the Cordua Irrigation District. Although the new screen does not fully meet all DFG and NMFS criteria, the rehabilitation efforts have greatly improved the effectiveness of the screen by installing appropriate sized punch plate panels into the screen, creating favorable hydrological conditions along the face of the screen, allowing continuous operation of the screen throughout the irrigation season and providing direct return of entrained fish back to the river below the dam.

A new state-of-the-art fish screen was installed at the Brown's Valley diversion facility in 1999 which meets all NMFS and DFG screening criteria and is no longer considered to pose a threat of entrainment for juvenile salmonids.

All of these diversions capture water that would otherwise flow downstream to contribute to the critical habitat below Daguerre Point Dam. This reduction in flow results in increased warming of the lower river below Daguerre Point Dam and dewatering of an incremental portion of the flood plain, thereby reducing the amount of critical habitat available to spring-run chinook salmon and steelhead.

Synthesis of Effects

Yuba River salmonid populations have endured almost 150 years of intense human degradation of their riverine habitat starting with hydraulic gold mining in the mid-nineteenth century and continuing through the construction of dams and the ongoing development of water for hydropower and consumptive uses. On top of these impacts, the introduction of non-native predatory fish, continued mining operations and the degradation of riparian SRA habitat have contributed to the decline of these fish to the point that two, the spring-run chinook salmon and the steelhead, have been listed as threatened under the Endangered Species Act.

The greatest impact to listed salmonids associated with the Corps' operations on the Yuba River is the complete blockage of access for these species to their historical spawning and rearing habitat above Englebright Dam. Because this historic habitat is no longer accessible, spring-run chinook salmon and steelhead are relegated to the lower most reach of the river which contains only marginal habitat that was not historically used to any great extent for spawning by these species. This makes these populations particularly vulnerable to the project operations of the Corps.

The alteration of the natural hydrologic cycle due to dam operations on the Yuba River has the potential to adversely affect critical habitat below the dams as well as having direct effects on all life stages of listed salmonids. Reservoir releases resulting in large scale flow fluctuations can cause adverse effects such as redd dewatering or scouring and stranding of juvenile and adult fish. Extended periods of low flow releases can result in increased temperatures and reduced habitat availability.

Upstream passage at Daguerre Point Dam is often problematic for migrating salmonids due to the height of the dam and inadequacies of the fish ladders. Delays in passage and the expenditure of excess energy in attempting to pass dams have been shown to have a number of adverse effects on pre-spawning salmonids. Adverse impacts associated with entrainment of juvenile salmonids may occur within the irrigation diversions associated with Daguerre Point Dam. There is also an elevated risk of predation created when juveniles plunge over the dam into the pool below. The diversion of water out of the Yuba River at Daguerre Point Dam reduces flows below the dam which may result in increased water temperatures and reduced quality and quantity of critical habitat.

Impacts on Evolutionarily Significant Unit Survival and Recovery

In examining the potential impacts of the Corps' operations of Englebright and Daguerre Point Dams on the threatened Central Valley spring-run and steelhead ESUs, NMFS must determine whether or not those impacts are likely to reduce the numbers, reproduction or distribution of the affected fish in such a way that their likelihood of recovery and survival within the action area is appreciably reduced, and if so, how those local reductions are likely to affect the ESUs likelihood of survival and recovery throughout the Central Valley.

The long standing impacts on Central Valley spring-run chinook salmon and Central Valley steelhead resulting from Englebright and Daguerre Point Dams on the lower Yuba River have been severe. It is likely that these impacts, if left uncorrected, would cause continued reductions in population size, reproductive success and distribution of these species, and further reduce the value of their critical habitat within the action area.. However, recent changes to the operational procedures as well as the physical structures associated with these two dams have provided a level of improvement to the situation for listed salmonids and their critical habitat within the lower Yuba River. Additionally, there are further actions planned for implementation within the next year that are expected to further improve conditions for listed salmonids and their critical habitat.

Recent improvements that have been implemented within the last few years include the following:

- A state-of-the-art fish screen has been constructed on the Browns Valley diversion, greatly reducing the potential for this diversion to adversely impact listed fish.

- The fish screen on the Cordua/Hallwood diversion has been completly refurbished, which has greatly reduced the potential for this diversion to adversely impact listed fish.

- Adjustable flash boards have been attached to the crest of the spillway of Daguerre Point Dam. These flashboards are designed to improve the effectiveness of the fish ladders by accomplishing the following two goals; The flashboards increase the head behind the dam, thereby forcing more water into the fish ladders during dry conditions and improving attraction and passage through the ladders; also, the positioning of the flash boards forces the water that is flowing over the dam to the outer edges of the spillway where it provides attraction flow to the entrances to the ladders and eliminates the false attraction from flow that previously went over the middle of the dam where there is no passage.

- The instream flows, ramping criteria and other protections called for in D-1644 insure that at least some level of instream flow will be provided along with other protections mandated by the decision. Long term instream flow requirements will be instituted in April, 2006 which will provide a higher level of protection for fisheries habitat, primarily in dry and critically dry years.

- Finally, PG&E has recently conducted significant repairs and maintenance on their power lines and delivery facilities so as to greatly reduce the potential of future powerplant shut-downs resulting in uncontrolled flow fluctuations (Curt Aikens, YCWA, pers. com. 2001).

The improvements to the screening facilities have greatly reduced mortality of listed juvenile salmonids at these diversions, thereby increasing the size of the juvenile cohort returning to the ocean each year. Preliminary observations of the experimental placement of flash boards on top of Daguerre Point Dam indicate some promise for improving fish passage at the dam by increasing flows in the ladders and routing excess flows towards the downstream entrances to the ladders to act as attraction to these entrances, although no study of this practice has been completed yet. Improvement in upstream passage would increase the reproductive success of listed salmonids by reducing the time and energy spent in attempting to pass the dam and by reducing the likelihood of a fish being forced to spawn in the lower quality habitat below the dam. The repairs and improvements made to the PG&E facilities has lowered the probability of an unplanned shutdown of the power plants which could cause large scale flow fluctuations in the lower Yuba River. This reduction in the potential for such fluctuations provides an added level of protection against the adverse effects associated with these flow fluctuations such as mortality of eggs and pre-emergent fry from dewatering of redds and stranding or isolation of free swimming juveniles and adults due to quickly receding water levels.

Further improvements that are expected to be implemented within the next year include:

- The Corps plans to implement long term programs to improve fish ladder maintenance and sediment management at Daguerre Point Dam,

- The Corps plans to implement a spawning gravel injection program in the area below Englebright Dam to improve the quality of spawning habitat in that area.

- The Corps plans to conduct improvements to the South Yuba-Brophy Diversion facilities to reduce the adverse effects associated with that diversion.

Because these actions have not yet been implemented nor even fully planned, it is impossible to determine the level of improvement that such actions might provide for listed salmonids on the Yuba River. If these actions are successfully implemented, it is reasonable to expect some level of improvement in fish passage at Daguerre Point Dam, improved spawning habitat below Englebright Dam and reduced entrainment of juvenile fish at the South Yuba-Brophy diversion.

All of these improvements have not, and will not, completely remove the adverse effects associated with Englebright and Daguerre Point Dams on the Central Valley steelhead and spring-run chinook salmon in the lower Yuba River, and reductions in the abundance, distribution, or reproductive success of these species will still occur. However, these improvements provide indicate that environmental conditions resulting from project operations have and will continue to improve beyond the operations and conditions that brought these populations to their current status. Therefore, NMFS finds that it is reasonable to expect that the recent and near term improvements will at least stabilize population levels if not slightly increase them during the 5 year term of this Opinion as a result of decreases in the chronic effects of reduced survival of these species under past operations. NMFS has therefore determined that the level of impacts over the five year period covered by this opinion, is unlikely to reduce the population numbers, reproductive success or the distribution of listed salmonids in the Yuba River to the point of reducing these populations' likelihood of survival and recovery.

Critical Habitat

Many of the above-listed measures intended to improve salmonid populations in the lower Yuba River will do so by improving the condition or increasing the amount of critical habitat upon which these fish rely. Those measures that provide flows, improve water temperatures or inject spawning gravel into depleted areas all are expected to improve the quality and/or quantity of critical habitat. Many of these measures have already been implemented or are included in the project description for immediate implementation. It is therefore reasonable to expect that under these improved conditions, and in the absence of any catastrophic events, the critical habitat in the lower Yuba River should at least maintain its current condition if not slightly improve over the short term. Therefore, NMFS does not expect that the proposed action will diminish the value of designated critical habitat for the survival and recovery of the Central Valley steelhead and spring-run chinook salmon.

VI. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. Beyond the ongoing effects of actions identified in the *Environmental Baseline* section, NMFS is unaware of any reasonably certain to occur plans or proposals for future non-federal actions that may affect the lower Yuba River.

VII. CONCLUSION

After reviewing the current status of the threatened Central Valley spring-run chinook salmon and Central Valley steelhead, the environmental baseline for the action area, the effects of future operations of Englebright Dam/Englebright Lake and Daguerre Point Dam and the cumulative effects, it is NMFS' biological opinion that operations of Englebright Dam/Englebright Lake and Daguerre Point Dam on the Yuba River over the next five years are not likely to jeopardize the continued existence of these species, and are not likely to destroy or adversely modify designated critical habitat for these species.

VIII. INCIDENTAL TAKE STATEMENT

Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the proposed action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this Incidental Take Statement.

The measures described below are nondiscretionary, and must be undertaken by the Corps so that they become binding conditions of any permits issued or project descriptions, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activities covered by this incidental take statement. If the Corps fails to assume and implement the terms and conditions, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to NMFS as specified in this Incidental Take Statement. (50 CFR §402.14(I)(3))

Amount or Extent of Take

The various impacts associated with the Corps operations of Englebright and Daguerre Point Dams have the potential to harm, harass and/or kill each life stage of Central Valley steelhead and spring-run chinook salmon. Dam operations resulting in an altered hydrograph on the lower Yuba River can harm or kill listed fish and viable eggs in a variety of ways, such as redd scouring or dewatering, stranding of fish and degradation of habitat features and ecosystem functions.

Delays and/or blockage of migration at the two dams can cause the loss of spawning viability of adult fish by reducing their ability to reach higher quality spawning habitat above the dams. The diversion of water at Daguerre Point Dam causes harm to listed salmonids by reducing flows below the dam which results in seasonal increases in water temperature and reduced quality and quantity of critical habitat below these diversion points. Direct entrainment of juvenile spring-run chinook salmon and steelhead resulting in the death or harm to these fish, may occur within the diversions associated with Daguerre Point Dam.

The actual number of individuals likely to be subjected to each form of take from this project is impossible to determine due to annual variations in population size, run timing, meteorological conditions, water storage conditions and water management practices.

Because of the unpredictable nature of the annual amount of take likely to be caused by the many aspects of the Corps operations on the lower Yuba River, NMFS has determined that the take of listed species may be measured through compliance with Reasonable and Prudent Measures 1 through 3 and their implementing terms and conditions in this Incidental Take Statement, as well as the project description provided in the biological assessment for this project and the effects analysis contained within this Opinion. Any action that is not in compliance with these documents and conditions may cause an exceedence in anticipated take levels, thereby triggering the need to reinitiate consultation on the project.

Effect of the Take

In the accompanying biological opinion, NMFS has determined that the level of anticipated take is not likely to jeopardize the continued existence of listed Central Valley spring chinook salmon, or Central Valley steelhead or to result in the destruction or adverse modification of critical habitat over the five year time period analyzed in this Opinion and covered by this incidental take statement.

Reasonable and Prudent Measures

NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize take of Central Valley spring chinook salmon and Central Valley steelhead:

1. The Corps shall seek to improve the effectiveness and reliability of the fish ladders on Daguerre Point Dam.

2. The Corps shall implement interim as well as long term improvements to the South Yuba - Brophy irrigation diversion to reduce impacts of that facility on juvenile salmonids.

3. The Corps shall develop and implement a gravel injection program in key areas on the Yuba River which have been deprived of adequate spawning gravels by the interruption of recruitment of gravel by the construction of Englebright Dam.

4. As provided for in 50 CFR 402.14 (I)(3), the Corps shall provide an annual report on the progress and effectiveness of the above measures.

Terms and Conditions

The Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. The Corps shall seek to improve the effectiveness and reliability of the fish ladders on Daguerre Point Dam.

    A. The Corps shall develop and implement a plan to routinely clear debris from the two fish ladders on Daguerre Point Dam and construct sides and/or trash racks on the ladder exits to divert debris away from the ladder. This plan should be added to the requirements contained in the Corps Operation and Maintenance Manual for Daguerre Point Dam. A final draft of this plan will be submitted to NMFS Sacramento office at the address given below within six months of the issuance date of this biological opinion, with an implementation date no later than one year from the issuance date of this biological opinion.

    B. The Corps shall install a remote pressure/transducer device in the ladders to monitor the debris accumulating in each ladder by October 1, 2002..

    C. The Corps shall develop and implement a plan to routinely remove or otherwise manage the sediments that accumulate on the upstream side of Daguerre Point Dam so as to prevent these sediments from impeding passage of listed species.

This plan should be added to the requirements contained in the Corps O&M Manual for Daguerre Point Dam. A final draft of this plan will be submitted to NMFS Sacramento office at the address given below within six months of the issuance date of this biological opinion, with an implementation date no later than one year from the issuance date of this biological opinion.

2. The Corps shall implement interim as well as long term improvements to the South Yuba - Brophy irrigation diversion to reduce impacts of that facility on juvenile salmonids.

   A. The Corps or their licencee (South Yuba Water District) shall implement interim actions to improve conditions for juvenile salmonids at the South Yuba-Brophy irrigation diversion by clearing debris from the feeder channel and eliminating the large pool directly in front of the diversion weir. These actions are expected to reduce the take of listed salmonids at the diversion by increasing the rate of flow through the feeder channel and reducing exposure time as fish are transported past the cobble weir. These actions are also expected to reduce the attractiveness of the area for predatory fish such as Sacramento pike-minnow.

   B. If the final outcome of the on-going fish passage improvement program at Daguerre Point Dam maintains the current point of diversion at the South Yuba-Brophy irrigation diversion, the Corps shall coordinate with the Brophy Irrigation District, NMFS, DFG, and the FWS to develop and implement a plan to fully screen that diversion to meet all DFG and NMFS screening criteria.

3. The Corps shall develop and implement a gravel injection program to provide suitable spawning gravel to key areas on the Yuba River which have been deprived of adequate gravel recruitment due to the existence of Englebright Dam.

   A. A final draft of the implementation plan for the gravel injection program on the lower Yuba River shall be submitted to NMFS Sacramento office at the address given below within six months of the issuance date of this biological opinion. Implementation of this plan shall commence no later than one year from the issuance date of this biological opinion.

4. As provided for in 50 CFR 402.14 (I)(3), the Corps shall provide an annual report on the progress and effectiveness of the above measures.

   A. The Corps shall submit to NMFS an annual report detailing the progress that is being made towards the implementation of the above listed measures and the effectiveness of those measures once they have been fully implemented. Each report should provide details such as the frequency of ladder cleaning and maintenance; the frequency and duration of ladder closures due to cleaning, high river flows or any other cause; exact location and tonnage of gravel injected for habitat restoration; and any other details pertinent to the successful implementation of these measures.

The first report is due to NMFS one year from the date of issuance of this biological opinion and successive reports will be due at one year intervals throughout the five year period covered by this incidental take statement. The final report will be due to NMFS in 2007.

Updates and reports required by these terms and conditions shall be submitted to:

Office Supervisor
Sacramento Area Office
National Marine Fisheries Service
650 Capitol Mall, Suite 8-300
Sacramento, CA 95814
FAX: (916) 930-3629
Phone: (916) 930-3604
email: Michael.Tucker@noaa.gov

If the Corps, in their operations of their Yuba River facilities, violates any of the terms and conditions set forth in this incidental take statement, or fails to operate the project as described in the DESCRIPTION OF THE PROPOSED ACTION section of this Opinion, the level of incidental take anticipated in the accompanying biological opinion will be exceeded. Such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. If such a situation arises, the Corps must immediately notify NMFS to provide an explanation of the increase in take and review with NMFS the need for reinitiation of consultation and modification of the reasonable and prudent measures or project actions.

IX. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on a listed species or critical habitat, to help implement recovery plans, or to develop information.

1. In order to fulfill their obligations under Section 7(a)(1) of the Act, the Corps should take an active roll in the current efforts to improve the facilities and adjust the

operations of Englebright Dam so as to improve conditions for salmonid reproduction and survival on the lower Yuba River.

2 In order to fulfill their obligations under Section 7(a)(1) of the Act, the Corps should coordinate with the various entities involved in managing flows from Englebright Lake and New Bullards Bar Reservoir to provide sufficient flows at the appropriate times of year, to enhance critical habitat (instream and SRA) and water temperature in the Yuba River downstream of Englebright Lake.

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, NMFS requests notification of the implementation of any conservation recommendations.

X. REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the proposed operations of Englebright Dam/Englebright Lake and Daguerre Point Dam. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary federal involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take authorized in the accompanying incidental take statement is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in this opinion; (3) the action is subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

Additionally, the total time period covered under this biological opinion shall not exceed five years from the date of its issuance. At that time all provisions of this biological opinion shall expire, including any coverage for incidental take. The Corps will then be required to reinitiate formal consultation on the effects of operations of Englebright Dam/Englebright Lake and Daguerre Point Dam on any species which may be listed at that time. The reason for the establishment of this time limit is that several comprehensive programs designed to develop biologically sound solutions to many of the most serious problems facing anadromous salmonids on the Yuba River are currently underway. Over the next few years, these programs are expected to produce extensive new information on the impacts and potential solutions to those impacts associated with operations of Englebright Dam/Englebright Lake and Daguerre Point Dam. The programs and studies which are expected to provide this important information include the Upper Yuba Studies Program, the Daguerre Fish Passage Improvement Program, the SWRCB decision settlement process, as well as several smaller scale biological studies currently being conducted by DFG and YCWA.

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Enclosure 2

Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA)

ESSENTIAL FISH HABITAT CONSERVATION RECOMMENDATIONS[1]

U.S. Army Corps of Engineers (Corps) operations of Englebright Dam/Englebright Lake and Daguerre Point Dam

I. IDENTIFICATION OF ESSENTIAL FISH HABITAT

The geographic extent of freshwater essential fish habitat (EFH) for the Pacific salmon fishery includes waters currently or historically accessible to salmon within specific U.S. Geological Survey hydrologic units (Pacific Fisheries Management Council 1999). For the Sacramento River watershed, the aquatic areas identified as EFH for chinook salmon are within the hydrologic unit map numbered 18020109 (Lower Sacramento River) and 18020112 (upper Sacramento River to Clear Creek). The upstream extent of Pacific salmon EFH in the Yuba River is to Englebright Dam at river mile (RM) 23.9.

EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purpose of interpreting the definition of essential fish habitat, "waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means habitat required to support a sustainable fishery and a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle.

The associated biological opinion thoroughly addresses the species of chinook salmon listed under the Endangered Species Act (ESA) as well as the MSFCMA which will potentially be affected by the proposed action, the Central Valley spring-run chinook salmon (*Oncorhynchus tshawytscha*). Therefore, this EFH consultation will concentrate most heavily on the Central Valley fall/late fall-run chinook salmon (*O. tshawytscha*) which is also covered under the MSFCMA although not listed under the ESA.

[1]The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) set forth new mandates for the National Marine Fisheries Service (NMFS) and federal action agencies to protect important marine and anadromous fish habitat. Federal action agencies which fund, permit, or carry out activities that may adversely impact EFH are required to consult with NMFS regarding potential adverse effects of their actions on EFH, and respond in writing to NMFS "EFH Conservation Recommendations." The Pacific Fisheries Management Council has identified essential fish habitat (EFH) for the Pacific salmon fishery in Amendment 14 to the Pacific Coast Salmon Fishery Management Plan.

The Sacramento, Feather, Yuba, American, Cosumnes, Mokelumne, Stanislaus, Tuolumne, Merced, and San Joaquin Rivers, and many of their tributaries, support wild populations of the fall/late-fall chinook salmon ESU. However, forty to fifty (40-50) percent of spawning and rearing habitats once used by these fish have been lost or degraded. Fall/late-fall run (herein "fall-run") chinook salmon were once found throughout the Sacramento and San Joaquin River drainages, but have suffered declines since the mid-1900s as a result of several factors, including commercial fishing, blockage of spawning and rearing habitat, water flow fluctuations, unsuitable water temperatures, loss of fish in overflow basins, loss of genetic fitness and habitat competition due to straying hatchery fish, and a reduction in habitat quality.

All chinook salmon in the Sacramento/San Joaquin Basin are genetically and physically distinguishable from coastal forms (Clark 1929). In general, San Joaquin River populations tend to mature at an earlier age and spawn later in the year than Sacramento River populations. These differences could have been phenotypic responses to the generally warmer temperature and lower flow conditions found in the San Joaquin River Basin relative to the Sacramento River Basin. There is no apparent difference in the distribution of marine coded wire tag (CWT) recoveries from Sacramento and San Joaquin River hatchery populations, nor is there genetic differences between Sacramento and San Joaquin River fall-run populations (based on DNA and allozyme analysis) of a similar magnitude to that used in distinguishing other ESUs. This apparent lack of distinguishing life-history and genetic characteristics may be due, in part, to large-scale transfers of Sacramento River fall-run chinook salmon into the San Joaquin River Basin.

Central Valley fall-run chinook salmon are often caught in monitoring efforts throughout the basin which are primarily focused on studying winter-run and spring-run chinook salmon. However, despite many diverse sources of information, there has been little effort at coordinating data to attain population estimates, or to determine the viability of the wild fall-run populations remaining in the Central Valley. A general increase in salmon runs in the Sacramento River since 1990 may be attributable to several factors including, increased water supplies following the 1987-1992 drought, stricter ocean harvest regulations, and fisheries restoration actions throughout the Central Valley. This population increase has likely carried over to the wild fall-run chinook salmon population as well. Chinook salmon production is supplemented by fall and late-fall chinook salmon reared at the U.S. Fish and Wildlife-operated Coleman Fish Hatchery on the Sacramento River; and California Department of Fish and Game-operated Feather River Hatchery on the Feather River, Nimbus Hatchery on the American River, and Mokelumne Hatchery on the Mokelumne River (all fall-run chinook salmon). There are indications that fall-run populations are generally stable or increasing, but it is unclear if natural populations are self-sustaining or if the appearance of stability is due to high hatchery production. Concern remains over impacts from high hatchery production and harvest levels, although ocean and freshwater harvest rates have been recently reduced.

Estimates of fall-run chinook escapement in the lower Yuba River since 1953 have indicated that the population has remained relatively stable, with a slow but statistically significant increase over time. Prior to the construction of New Bullards Bar Reservoir (1953-1971), the average estimated escapement was 12,906 fish, with a range of 1,000 to 37,000 fish. Since construction of New Bullards Bar Reservoir (1972-1999), the average estimated escapement is 14,421 to 15,119 (depending on the methodology used), with a range of 3,779 to 39,367 fish (Table 1). The run is maintained primarily by natural production, since there are no long-term stocking programs in the lower Yuba River, and the extent of straying from other hatchery stocks in the Sacramento River Basin is believed to be low.

Table 1. Estimated annual fall-run chinook salmon spawning escapement in the lower Yuba River prior to and after the completion of New Bullards Bar Reservoir (Source: YCWA, 2000).

Pre- New Bullards Bar Reservoir		**Post- New Bullards Bar Reservoir**	
Year	**Estimated Escapement**	**Year**	**Estimated Escapement**
1953	6,000	1972	9,258
1954	5,000	1973	24,119
1955	2,000	1974	17,809
1956	5,000	1975	5,641
1957	1,000	1976	3,779
1958	8,000	1977	8,722
1959	10,000	1978	7,416
1960	20,000	1979	12,430
1961	9,000	1980	12,406
1962	34,000	1981	14,025
1963	37,000	1982	39,367
1964	35,000	1983	14,256
1965	10,000	1984	9,965
1966	8,000	1985	13,066
1967	23,500	1986	19,406
1968	7,000	1987	18,510
1969	5,230	1988	8,501
1970	13,830	1989	9,837
1971	5,650	1991*	14,413
-	-	1992	6,361
-	-	1993	6,516
-	-	1994	10,691
-	-	1995	14,561

Pre- New Bullards Bar Reservoir		Post- New Bullards Bar Reservoir	
Year	Estimated Escapement	Year	Estimated Escapement
-	-	1996	27,520
-	-	1997	25,778
-	-	1998	30,802
-	-	1999	23,067
Average	12,906	Average	15,119
Variance	129,843	Variance	74,069

* No estimate made in 1990.

Life History and Habitat Requirements

Central Valley fall-run chinook are "ocean-type", entering the Sacramento and San Joaquin Rivers from July through April, and spawning from October through December. Peak spawning occurs in October and November (Reynolds et al. 1993). Chinook salmon spawning generally occurs in swift, relatively shallow riffles or along the edges of fast runs at depths greater than 6 inches, usually 1-3 feet to 10-15 feet. Preferred spawning substrate is clean loose gravel. Gravels are unsuitable for spawning when cemented with clay or fines, or when sediments settle out onto redds reducing intergravel percolation (NMFS 1997).

Egg incubation occurs from October through March, and juvenile rearing and smolt emigration occurs from January through June (Reynolds et al. 1993). Shortly after emergence from their gravel nests, most fry disperse downstream towards the Delta and estuary (Kjelson et al. 1982). The remainder of fry hide in the gravel or station in calm, shallow waters with bank cover such as tree roots, logs, and submerged or overhead vegetation. These juveniles feed and grow from January through mid-May, and emigrate to the Delta and estuary from mid-March through mid-June (Lister and Genoe 1970). As they grow, the juveniles associate with coarser substrates along the stream margin or farther from shore (Healey 1991). Along the emigration route, tributary streams are used as rearing habitat. These non-natal rearing areas are highly productive micro-habitats providing abundant food and cover for juvenile chinook salmon to grow to the smolt stage. Smolts are juvenile salmonids that are undergoing a physiological transformation that allows them to enter saltwater. These smolts generally spend a very short time in the Delta and estuary before entry into the ocean.

In contrast, the majority of fry carried downstream soon after emergence are believed to reside in the Delta and estuary for several months before entering the ocean (Healey 1980, 1982; Kjelson et al. 1982). Principal foods of chinook while rearing in freshwater and estuarine environments are larval and adult insects and zooplankton such as *Daphnia,* flys, gnats, mosquitoes or copepods (Kjelson et al. 1982), stonefly nymphs or beetle larvae (Chapman and Quistdorff 1938) as well as other estuarine and freshwater invertebrates. Whether entering the

Delta or estuary as a fry or juvenile, fall-run chinook depend on passage through the Sacramento-San Joaquin Delta for access to the ocean.

The fish rear in calm, marginal areas of the river, particularly back eddies, behind fallen trees, near undercut tree roots or over areas of bank cover, and emigrate as smolts from April through June. They remain off the California coast during their ocean migration

II. PROPOSED ACTION

The proposed action is described in the *Description of the Proposed Action* section of the associated Biological Opinion (Enclosure 1) for the threatened Central Valley steelhead, and Central Valley spring-run chinook salmon ESUs.

III. EFFECTS OF THE PROJECT ACTION

Englebright Dam

Englebright Dam blocks access by anadromous salmon to all of the high elevation, cold water habitat above the dam, including all three forks of the Yuba River and the many small tributaries which make up the upper watershed. Operation of Englebright Reservoir, including the storage and subsequent release of water, alters the natural flow regime by which juvenile and adult s base their migrations. This altered flow regime also upsets the natural hydrological process resulting in decreased recruitment of gravel and large woody debris into the lower river. The lack of upstream access coupled with the downstream impacts greatly reduces the capacity of the Yuba River to maintain healthy, stable populations of fall-run chinook salmon.

Englebright Dam also inhibits regeneration of riparian vegetation and critical SRA habitat by preventing the transport of fine sediment, woody debris, and nutrients from upstream sources to the lower river. Subsequently, mature riparian vegetation is sparse and intermittent along the lower Yuba River, leaving much of the bank areas unshaded and lacking in large woody debris. Juvenile salmon depend on such habitat for resting and avoidance of predators as well as the food source provided by the many aquatic invertebrates associated with this vegetative material. Healthy riparian cover also helps to shade the stream, providing cooler water temperatures and cover for both juveniles and adults. The loss of riparian cover has greatly diminished the value of critical habitat in this area, possibly reducing the survival of salmon in the Lower Yuba River.

<u>Flow Fluctuations</u>
The Narrows II power plant has a maximum generating capacity of 3,400 cfs and a bypass capability of only 650 cfs. This design leaves the potential for a major drop in flows (up to 2,750 cfs drop) if a shut down becomes necessary while the plant is at maximum capacity.

Emergency shut downs in the past have resulted in flows temporarily (up to 2 hours) dropping below 650 cfs due to delays in the activation of the bypass mechanism. The Narrows I power plant has the capability of full bypass of the maximum generating capacity of the plant (650 cfs) in the event of a shut-down. Therefore, the only potential for a significant drop in flows due to Narrow I operations would be a failure or delay in the activation of the bypass mechanism. Large scale, prolonged reductions in flows out of Englebright Dam resulting from normal maintenance or emergency operations of the Narrows I and II powerhouses have the potential to cause significant adverse effects to salmon such as stranding of juvenile and adult fish, dewatering of spawning areas and other habitat, and elevated water temperatures.

Minimum flow requirements

On March 1, 2001, the SWRCB issued its final decision (D-1644) regarding the protection of fishery resources and other issues relating to diversion and use of water from the lower Yuba River. Among other requirements, D-1644 specified new minimum flow requirements and flow fluctuation criteria for the lower Yuba River. Through their testimony at the SWRCB hearings and comments submitted on preliminary drafts of the decision, NMFS, DFG and FWS, provided expert biological information showing that the minimum flows adopted by the SWRCB in D-1644 are insufficient to insure that water temperatures and other habitat conditions within the lower Yuba River will remain suitable for all life stages of salmon in the river, especially in dry and critical years.

One risk to salmon associated with insufficient flows is the potential for elevated water temperatures which have been shown to cause many adverse effects on the various life stages of chinook salmon. The most definitive data on the effects of elevated water temperatures on adult chinook salmon are related to critical thresholds affecting acute mortality and disease outbreaks, both in hatcheries and in the wild. The deteriorating physiological condition of Pacific salmon upon their seasonal maturation and upstream spawning migration render them vulnerable to environmental stressors, such as elevated water temperature. Opportunistic pathogens can gain advantage over the salmon's natural immunological defenses, resulting in disease. Elevated water temperatures can impose metabolic and physiological stresses, which can impair immunological functions in salmon and increase their susceptibility to disease. The stress that can be caused by exposure to elevated water temperatures in adult chinook salmon may exacerbate the already-compromised immune system that results from the dramatic physiological stresses associated with re-entering freshwater and final sexual maturation (Marine 1997).

Daguerre Point Dam

Fish Passage

Adult fish passage at Daguerre Point Dam is considered inadequate for chinook salmon throughout much of the year (CDFG 1991). Adult fish passage is severely impaired during high flow conditions at the dam. Throughout winter and spring when flows are high, adult fish experience difficulty in finding the entrance to the ladders because of the very small percentage of attraction flows coming out of the ladders compared to the massive sheetflow coming over the rest of the dam. The angle of the orifices and proximity to the plunge pool also increase the difficulty for fish to find the entrances to the ladders. Other design deficiencies which have been identified include periodic obstruction of the ladders by woody debris, operating criteria that require closure of the ladders at high flows, and the proximity and orientation of the ladder entrances to the spillway (CDFG 1991). Large schools of adult salmon have been observed congregating in the plunge pool below the dam and leaping at the face of the dam, indicating that migrating adults may not readily find the entrances to the fish ladders. This lack of free passage may lead to injury, delayed migration, increased depletion of precious energy reserves and/or pre-spawning mortality.

Juvenile salmon can also be adversely affected by Daguerre Point Dam on their downstream migration. The large plunge pool at the base of the dam creates an area of unnatural advantage for predatory fish such as Sacramento pikeminnow, large mouth bass , striped bass, American shad and adult rainbow trout/steelhead which seasonally inhabit this section of the Yuba River. The deep pool provides excellent ambush habitat for predators in an area where juvenile salmon can be disoriented or injured as they plunge over the face of the dam into the turbulent waters at the base, making them highly vulnerable to predation. This unnatural advantage for predators increases the overall level of predation on juvenile salmon, thereby reducing the abundance of the juvenile cohort making it out to the ocean.

Water Diversions

There are three significant water diversions associated with Daguerre Point Dam that have a combined diversion capacity of 1,085 CFS. The three diversions include the South Yuba-Brophy diversion, the Hallwood-Cordua diversion and the Brown's Valley diversion,.

The South Yuba-Brophy diversion facility includes a 450-foot long porous rock weir fitted with a fine-mesh barrier within the weir. This device was intended to protect fish from the impacts of the diversion but it fails to meet many of the critical criteria developed by NMFS and DFG for adequate fish screen operation and fish safety.

The interstitial spaces between the rocks making up this weir are much larger than the required 3/32 inches defined in the NMFS Fish Screening Criteria for Anadromous Salmonids. There is a fine meshed fabric buried within the weir which may meet the opening size criteria (if it is still intact) but there is obviously no sweeping flow along the face of this fabric inside of the weir and therefore any fry which encounter this mesh, instead of being swept along the face of the fabric, would be more likely to become impinged on the fabric and perish.

Sweeping flows along the face of the weir are often minimal and occasionally non-existent. By agreement with the DFG, at least 10 percent of the water diverted from the Yuba River must bypass the weir structure. The stipulated 10 percent bypass flow is not always met (FWS 1990) and at times there has been no bypass flow at all with the outlet channel running completly dry (John Nelson, DFG, pers. com. 2001).

Another feature of the diversion intake area that is detrimental to juvenile salmon is the large, slow water pool that occurs within the intake canal directly in front of the porous rock weir. One problem with this pool is it's effect on flow velocity along the face of the rock weir. As water flows from the intake channel into this pool, the flow velocity slows considerably, reducing the sweeping flows along the face of the weir, which in turn increases the exposure time of any juvenile fish passing in front of the weir. Increased exposure time to the face of the weir increases the potential for those fish to be impinged into the weir. Another problem with this pool is it's attractiveness to large predatory fish. The pool's deep slow waters provide excellent holding and ambush habitat for large predatory fish such as Sacramento pikeminnow. On two separate occasions in the later summer of 2001, NMFS and DFG biologists have observed large schools of 20 to 30 pikeminnow actively feeding within this pool.

There have been several studies which have shown that the porous rock weir on the South Yuba-Brophy diversion does not exclude juvenile salmon from being entrained into this diversion. On several occasions, fishery biologists have captured juvenile salmon that were entrained behind the barrier either by passing through the weir or being washed over the top during high flows (USFWS 1990, Demko and Cramer 1994).

The continuation of current operations at the South Yuba-Brophy diversion is likely to cause a reduction in survival of juvenile chinook salmon due to entrainment and increased predation at the diversion headworks.

In the spring of 2000 the fish screen on the Hallwood-Cordua diversion was rebuilt by the Cordua Irrigation District. Although the new screen does not fully meet all DFG and NMFS criteria, the rehabilitation efforts have greatly improved the effectiveness of the screen by installing appropriate sized punch plate panels into the screen, creating favorable hydrological conditions along the face of the screen, allowing continuous operation of the screen throughout the irrigation season and providing direct return of entrained fish back to the river below the dam.

A new state-of-the-art fish screen was installed at the Brown's Valley diversion facility in 1999 which meets all NMFS and DFG screening criteria and is no longer considered to pose a threat of entrainment for juvenile salmon.

All of these diversions capture water that would otherwise flow downstream to contribute to the critical habitat below Daguerre Point Dam. This reduction in flow results in increased warming of the lower river below Daguerre Point Dam and dewatering of an incremental portion of the flood plain, thereby reducing the amount of critical habitat available to chinook salmon

IV. CONCLUSION

Upon review of the effects of the Corps operations of Englebright Dam/Englebright Lake and Daguerre Point Dam on the Yuba River, NMFS believes that the ingoing operations of dams and water diversions on the Yuba River adversely affect EFH of Pacific chinook salmon protected under MSFCMA.

V. EFH CONSERVATION RECOMMENDATIONS

As the habitat requirements of Central Valley fall/late fall-run chinook salmon within the action area are similar to those of the federally listed species addressed in the attached biological opinion, NMFS recommends that Reasonable and Prudent Measures numbers 1, 2, and 3 and their respective Terms and Conditions listed in the Incidental Take Statement prepared for the Central Valley spring-run chinook salmon and Central Valley steelhead ESUs in the associated Biological Opinion, be adopted as EFH Conservation Recommendations. Additionally, the following conservation recommendations taken from the attached biological opinion also address project impacts to fall-run chinook salmon. These recommendations are provided as advisory measures.

1. The Corps should take an active roll in the current efforts to improve the facilities and adjust the operations of Englebright Dam so as to improve conditions for salmonid reproduction and survival on the lower Yuba River.

2. The Corps should coordinate with the various entities involved in managing flows from Englebright Lake and New Bullards Bar Reservoir to provide sufficient flows at the appropriate times of year, to enhance critical habitat (instream and SRA) and water temperature in the Yuba River downstream of Englebright Lake.

VI. ACTION AGENCY STATUTORY REQUIREMENTS

Section 305(b)(4)(B) of the Magnuson-Stevens Act and Federal regulations (50 CFR § 600.920) to implement the EFH provisions of the Magnuson-Stevens Act require federal action agencies to provide a detailed written response to NMFS, within 30 days of its receipt, responding to the EFH Conservation Recommendations. The response must include a description of measures adopted by the Agencies for avoiding, mitigating, or offsetting the impact of the project on Pacific salmon EFH. In the case of a response that is inconsistent with NMFS' recommendations, the Agencies must explain their reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(j)).

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